ICT INTEGRATED LEARNING MATERIALS ON BASIC SCHOOL SUBJECTS FROM CONSTRUCTIVIST PERSPECTIVES

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REGIONAL INSTITUTE OF EDUCATION
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING
BHUBANESWAR
2009

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PREFACE

Rapid advances in information and communication technology (ICT) have created unprecedented opportunities in the field of education. Mastering ICT skills and utilizing ICT towards creating an improved teaching and learning environment is of utmost importance to teachers in creating a new learning culture. Pedagogy-Technology integration plays a key role in this transformation. This new development in ICT has had a huge impact on the role of teachers in an information intensive society. Many teachers lack the knowledge and skills to effectively use ICT as a tool in facilitating learning in increasingly ICT-pervasive learning environments. Changes may be introduced in both teaching-learning methods and in content. Students can enjoy learning actively, such as by bringing the outside world into the classroom or by interacting with peers, experts and others. Furthermore, the students will have the opportunity to learn new skills, such as locating appropriate information, making informed choices by learning to recognize the authenticity of sources, and collaborating with other learners. The fundamental role of the teacher is to facilitate learning and to help to create autonomous learners who can continue to learn by themselves, especially with the assistance of new ICT. There is, however, a definite deficit in the knowledge and skills needed to use ICT as an effective teaching-learning tool. Well-trained teachers using ICT are few, and there are some who regard technology as a threat to their confidence as the main source of knowledge. In addition, pupils often have better computer skills than their teachers, further undermining teachers' authority. For teacher training, ICT will always remain an instrument or tool in education, and teachers will utilize technology rather than be manipulated by it. New technology does have great potential for enhancing the effectiveness of the teaching learning processes and has had profound influence on the role of teachers, but it will never replace the teacher nor will it eliminate exchange between the teacher and the taught. This interaction will remain essential and crucial to education. Technology by itself does not create miracles or solve all problems in education. The teacher training programme should not just be technology-driven, but should focus on the integration of technology with pedagogy. There are various emerging topics in pedagogy-technology integration that are becoming more and more important in the context of innovative teaching and learning practices. The rapid advances of Information Communication Technology principally facilitated these changes. In view of this here an attempt has been made to integrate ICT with constructivist pedagogy.

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INFORMATION AND COMMUNICATION TECHNOLOGIES IN A NEW PARADIGM OF LEARNING

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Abstract

Information and communication technologies have effectively revolutionized our society. In last two decades, technology has dramatically penetrated into every area of society and, every aspect of social and cultural lives. But, teaching, and the world of education more generally have not taken the advantage of these changes. We have largely failed to capitalize on the potential of new technologies, and particularly digital technology as a learning tool. We have allowed our schools to remain in the past, while our children have been born in the future. The result is the mismatch between the learner and the educator. But it is not the children who are mismatched to the schools; rather the schools are mismatched to the children. Only by revising educational practices, we can close this gap, and reunite our schools with our children and the rest of our society. The theoretical foundation for such changes exists, and time has come to implement it in practical sense. In view of this, here an attempt has been made to analyze the role of information and communication technologies in a new paradigm of learning.

Information and communication technologies have revolutionized our society. In last two decades, technology has dramatically penetrated into every area of society and, every aspect of social and cultural lives. Television was the initiator. Television rediscovered and recast the world as a direct experience. Computers made it possible for vast amount of information to be made instantly available and modified with a keystroke. The very nature of work has changed, with an increasing demand for workers who could master the new technologies and use them to conduct business that formerly did not require computer at all. Our children have been raised in a world of instant access to knowledge. They are used to create an environment where they control information flow and access with the press of a button, in which geographic mobility, intellectual flexibility, and the synthesis of work and learning are the norms in the work place.

Although schools are embedded in our culture and reflect its values, the technological changes that have swept through society at large have left the educational system largely unchanged. In last two decades a dramatic rift has opened between the process of teaching and learning in the school and the way of obtaining knowledge in society at large. There have been no wholesale revisions in the curriculum and no substantial change in the process of teaching. The result is an estrangement of the schools from society, and from the children who live in it.

This estrangement has a negative effect. The institutions responsible for educating our children are locked in the past. In the classroom knowledge is presented to them in a linear, didactic manner that differs dramatically from the children's previous experience outside the school. For the children, school is rigid, uninteresting and ultimately alienating. This divergence between our children and our educational practice needs a drastic educational reform so that it will bring the classroom and the society into one line. The immediate task for our school is to embrace the future and empower our children to learn with the technology.

We are entering a world that is changing in all spheres: scientific and technological, political, economic, social, and cultural. The emergence of the 'knowledge-based' society is changing the global economy and the status of education. There is growing an awareness among policy-makers, political leaders and educators that the educational system designed to prepare learners for an agrarian or industry-based economy will not provide students with the knowledge and skills they will need to thrive in the 21st century's knowledge-based economy and society. The new knowledge-based global society is one in which:

- the world's knowledge base doubles every 2–3 years;
- 7,000 scientific and technical articles are published each day;
- data sent from satellites orbiting the earth transmit enough data to fill 19 million volumes every two weeks;
- graduates of secondary schools in industrialized nations have been exposed to more information than their grandparents were in a life-time;
- there will be as much change in the next three decades as there was in the last three centuries (National School Board Association,USA,2002).

The challenge confronting our educational systems is how to transform the curriculum and teaching-learning process to provide students with the skills to function effectively in this dynamic, information-rich, and continuously changing environment.

The UNESCO Information and Communication Technologies in Teacher Education (2002) notes that the technology-based global economy also poses challenges to countries as national economies become more internationalized, with the increasing flow of information, technology, products, capital, and people between nations. This new economic environment is creating a new era of global competition for goods, services, and expertise. All of these changes are producing dramatic shifts in the political, economic and social structures of many countries around the world. These trends pose new challenges to educational systems to prepare students with the knowledge and skills needed to thrive in a new and dynamic environment of continuous technological change and accelerating growth in knowledge production. Education is at the confluence of powerful and rapidly shifting educational, technological and political forces that will shape the structure of educational systems across the globe for the remainder of this century. Many countries are engaged in a number of efforts to effect changes in the teaching/learning process to prepare students for an information and technology-based society.

The UNESCO World Education Report (1998) notes that the new technologies challenge traditional conceptions of both teaching and learning and, by reconfiguring how teachers and learners gain access to knowledge, have the potential to transform teaching and learning processes. ICTs provide an array of powerful tools that may help in transforming the present isolated, teacher-centred and text-bound classrooms into rich, student-focused, interactive knowledge environments. To meet these challenges, schools must embrace the new technologies and appropriate the new ICT tools for learning. They must also move toward the goal of transforming the traditional paradigm of learning.
Our aims as educators must go beyond specialized training of craftsmen or factory workers. The only true education is one where all arts, crafts, sciences, and technologies are linked and facilitate mutual cognitive development, productive creativity, and personal growth. The new literacy, a term used more than a decade ago (Anderson, 1993) to embrace the changed literacy demands resulting from the new technologies in schools, and ICT offer educators, perhaps for the first time, an opportunity to create such an ambitious scheme. In this ambitious scheme memorizing will not serve the purpose. Changes are needed in the status and functional role of teachers. Contemporary teachers do not have to pretend that they know everything in order to formulate problems and ways to solve them. At the same time, teachers have to play increasingly important roles of advisor and learning facilitator. The learners have to play the roles of responsible and active learner.

Three R's for the 21st century

The traditional notion of literacy (including so-called numeracy) was based on the Three Rs: Reading, Writing, and Arithmetic, together with accurate handwriting (preferably calligraphic), and memorizing certain excerpts from textbooks and classical poetry by heart.

The new literacy that is ICT-based and can be presented in three components corresponding to the traditional Three Rs:

- *Reading* – finding information by searching in written sources, observing, collecting, and recording;
- *Writing* – communicating in hypermedia involving all types of information and all media; and
- *Arithmetic* – designing objects and actions. (UNESCO, 2005)

The new literacy discourages memorization of facts and rules. It stresses the ability to find facts and imagine unprecedented options. A capacity to understand and invent rules, posing problems to oneself, planning and designing one's own activities, come to the forefront. The goal of this kind of education is not a narrow technical fluency, but personal development alongside the core competencies for high-level thinking and acting.

In the modern society one of the major changes in education can be described as a general shift from teaching to learning. The teacher's role is increasingly to assist students to become good learners. At the same time, teachers must help create stronger relationships between the subjects of study and concrete reality, putting them in a more relevant context for students. In many cases, this implies integration of disciplines and cooperation among teachers of different subject areas.

Scenario of Indian Schools

India is emerging as the fastest-growing economy in the world. Several international reviews predicted that 21st century belongs to India and China as much as 20th century belonged to the USA, and 19th century to Europe. Such international reviews also warn lot of pitfalls and landmines on the way. The success depends largely upon human resource development. But it is observed that the education being imparted in our schools and higher education institutions, including the vast majority of our best schools and colleges, is sub-standard.

As reported by Kurrien (2007) the results of a large-scale study conducted last year from the best 142 English-medium schools in five metro cities - Bangalore, Chennai, Kolkata, Mumbai and New Delhi - 32,000 students were selected from classes 4, 6 and 8. They were administered tests to evaluate their understanding of mathematics science and English. Students fared poorly in questions testing understanding or application of knowledge to new situations. They were only able to do answer questions based on recall or standard procedures. They were simply unable to answer questions that appeared to be different from what they typically encountered in their textbooks. Whatever else our best schools may claim to be teaching, clearly most of them are failing miserably in one of their principal goals - to help students understand what is learnt, relate it to the world outside the classroom and to think critically.

Are schools in other countries doing a better job of teaching their children?

We have no objective basis to make any comparative judgments, as India does not participate in international studies of student achievement. However, the study on our best schools did include 11 questions on mathematics and science that were taken from an international study of 43 participating countries. The results are indicative. Class 4 students from our best schools scored lower than even the average performance of class 3 students from these 43 countries on the same 11 questions. Even though this evidence is limited, it surely indicates that there is something rotten in the state of our top English-medium schools if our best students are performing worse than average students in other countries.

A similar false consciousness exists about the quality of our elite institutions of higher education. In the recently published 2007 Times Higher Education World University rankings, not a single Indian institution featured in the top 200. Of the 26 Asian universities in this list, Japan had 11 and China 6. Hong Kong, which has less than half the population of Mumbai, had 4 universities in the top 200. (Kurrien,2007)

As reported in the editorials of Times of India (18 December 2007) Elementary school must necessarily be viewed as a training ground for young minds. Unfortunately, in India, it is a battleground where children are forced to cram and learn by rote. It is proven that the development of cognitive abilities is not uniform among children. Their needs, interests, responsiveness necessarily differ. It is, therefore, crucial that teachers are equipped to address the specific needs of young children. It is imperative that the present one-dimensional and merely instructive flow of information — from tutor to the taught — is replaced by a more interactive system where learning is made meaningful. To that end, it does not matter if an elementary schoolteacher is a graduate or not. All that matters is that she is competent and up to the job. (It is Elementary, Editorial, Times of India, 18 December 2007)

In current scenario, institutions like NCERT, CBSE, Board of Secondary Education and SCERT of different states design the curricula, instructional methods, textbooks and other materials, which, after having a stamp of approval from ministries of education, are distributed to schools and teachers. A teacher's duty is to read and follow closely the body of these materials in order to deliver it piecemeal to students, who are expected to memorize the content one chunk after another, and checking in to see if they succeed. The basic, though rarely announced, assumption is that teachers need not add a word to what has been given from higher authorities. Teacher-to-student communication is predominantly oral. Visual aids are usually illustrations taken from books.

There is little hands-on activity with physical materials and tools on workbenches. The teacher is a lecturer, not a master of a craft. Little communication exists between teachers of different subjects on how to collaborate in making the educational process truly involving and effective. There is rigid timing; monologue lecturing and schools are considered as teaching institutions. The curriculum: a sum of disparate subjects.

The Traditional View of the Learning Process

The existing view of the learning process emerged out of the factory model of education at the turn of the 20th century and was highly effective in preparing large numbers of individuals with skills needed for low-skilled positions in industry and agriculture. The UNESCO Information and Communication Technologies in Teacher Education (2002) notes that the traditional educational paradigm is often characterized by the following views of learning:

Learning is hard. Many view learning as a difficult and often tedious process. According to this view, if students are having fun or enjoying what they are doing in a learning activity, they probably are not learning.

Learning is based on a deficit model of the student. The system strives to identify deficiencies and weaknesses of the student. Based on noted deficiencies, students are tracked, categorized, remediated or failed. The impact of the deficit model of student learning is most obvious in compensatory education programmes. Bruer, in his book, *Schools for Thought*, notes that research overwhelmingly concentrates on the weaknesses of poor children. Very little research has been done on their strengths. In addition, the weaknesses identified are often deficiencies in terms of the traditional organization and content of schooling. Very little thought has been given to the idea of changing schooling to accommodate new kinds of students; all the effort has gone to changing the students so that they will fit into the schools (Bruer, 1993).

Learning is a process of information transfer and reception. Much of our present learning enterprise remains "information-oriented," emphasizing students *reproducing knowledge* rather than *producing their own knowledge*. It also remains teacher-centered. Many still see the role of the teacher as a dispenser of information and the role of the student as a passive receiver, storer and repeater of the transmitted information.

Learning is an individual/solitary process. In a study of schools in the United States, the National Assessment of Educational Progress noted that most students spend long hours working alone at their desks completing worksheets or repetitive tasks. A London Times survey of English school children indicated that students almost unanimously rejected this daily ordeal of dull and ritualistically solitary classroom activity and called for a broader and more exciting curriculum. Above all, they wanted more work allowing them to *think for themselves*. They wanted to design and make things, to experiment and to engage in first-hand observation. The Times reported, however, that there was little evidence of changes in the curriculum that would respond to the students' wishes. (Resta, 1996)

Learning is facilitated by breaking content/instruction into small isolated units. The educational system is often geared more to categorizing and analyzing patches of knowledge than to sewing them together. Bruer (1993) notes that the technology of mass education is quite adept at "breaking knowledge and skills into thousands of little standardized, decontextualized pieces, which could be taught and tested one at a time." Neil Postman in his book, *Teaching as a Subversive Activity*, states that our educational systems break knowledge and experience into "subjects, relentlessly turning wholes into parts, history into events without restoring continuity." (Postman, 1969)

Learning is a linear process. Frequently, the textbook or teacher provides only one linear path through a narrowly bounded content area or sequence of standardized instructional units. For example, in a mathematics text only one correct problem solution trail may be offered for a specific subclass of problems. However, the problems encountered in daily life (or in mathematics) seldom have only one solution path or sequence.

New Paradigm of the Learning Process

The UNESCO Information and Communication Technologies in Teacher Education (2002) notes that in contrast to the traditional teaching-learning paradigm, a new paradigm of the teaching-learning process is emerging, based on three decades of research in human learning, that encompasses the following views of the human learning process:

Learning is a natural process. The natural state of the brain is to learn, however, not everyone learns in the same way. There are different learning, perceptual and personality styles that must be considered in the design of learning experiences for the individual student. Given interesting and rich learning environments, and supportive and stimulating teachers, students will learn. Teachers have often noted that children who appear disruptive or to have short attention spans when confronted with typical classroom instruction, may spend long periods engaged in meaningful and interesting computer-related activities.

Learning is a social process. The communal context of knowledge and learning is beginning to be rediscovered, as evidenced by the rapid growth of quality circles and computer-supported collaborative work in business, government, medicine, and higher education. As Vygotsky (1978) noted long ago, students learn best in collaboration with peers, teachers, parents, and others when they are actively engaged in meaningful, interesting tasks. ICTs provide opportunities for teachers and students to collaborate with others across the country and across the globe. They also provide new tools to support this collaborative learning in the classroom and online.

Learning is an active and not a passive process. In most fields, people are faced with the challenge of *producing knowledge* rather than simply *reproducing knowledge.* To allow students to move toward competence, they must be actively engaged in the learning process, in activities such as solving real problems, producing original writing, completing scientific research projects (rather than simply studying about science), dialoguing with others on important issues, providing artistic and musical performances, and constructing physical objects.

Learning may either be linear or non-linear. Much of what now happens in schools appears based on the notion that the mind works like a serial processor that is designed to process only one piece of information at a time in sequential order. But the mind is a wonderful parallel processor that may attend to and process many different types of information simultaneously.

Learning is integrative and contextualized. Pribram's holistic brain theory suggests that information presented globally is more easily assimilated than information presented only in a sequence of information elements (Pribram, 1991). It is also easier for students to see relations and to make connections.

Learning is based on a strength model of student abilities, interest, and culture. Based on the work of Howard Gardner and others, schools are beginning to consider the specific strengths and interests that students bring to the learning environment, and are designing learning activities that build on student strengths rather than focusing only upon remediating weaknesses. In addition, schools increasingly recognize diversity as a resource rather than a problem in the classroom.

Learning is assessed through task completion, products, and real problem solving of both individual and group efforts. Rather than simply evaluating students through paper and pencil tests, assessments are made using portfolios of actual performances and work in both collaborative and individual learning tasks. As noted by Driscoll (1994), we no longer can view learners as "empty vessels waiting to be filled, but rather as active organisms seeking meaning." Don Tapscott, in his book *Growing Up Digital: The Rise of the Net Generation* (1998), notes that we are entering a new era of digital learning in which we are in the process of transitioning from "broadcast" learning to "interactive" learning. Today's students no longer want to be passive recipients in the information transfer model of learning. Rather they want to be active participants in the learning process. There is growing recognition that today's world requires that students be able to work collaboratively with others, think critically and creatively, and reflect on their own learning processes.

A Paradigm Shift: From Teaching to Learning

As technology has created change in all aspects of society, it is also changing our expectations of what students must learn in order to function in the new world economy. Students will have to learn to navigate through large amounts of information, to analyze and make decisions, and to master new knowledge domains in an increasingly technological society. They will need to be lifelong learners, collaborating with others in accomplishing complex tasks, and effectively using different systems for representing and communicating knowledge to others. A shift from teacher-centred instruction to learner-centered instruction is needed to enable students to acquire the new 21st century knowledge and skills. The following table (Sandholtz, Ringstaff, and Dwyer, 1997) identifies the shift that will take place in changing from a focus on teaching to a focus on learning.

Table 1.1
Teacher-Centered and Learner-Centered Learning Environments

	Teacher Centered learning environments	*Learner centered learning environment*
Classroom activity	Teacher-centered, Didactic	Learner-centered, Interactive
Teacher role	Fact teller, Always expert	Collaborator, Sometimes learner
Instructional emphasis	Facts' memorization	Relationships, Inquiry and invention
Concepts of knowledge	Accumulation of facts, Quantity	Transformation of facts

Demonstration of success	Norm referenced	Quality of understanding
Assessment	Multiple choice items	Criterion referenced, Portfolios and performances
Technology use	Drill and practice	Communication, access, collaboration, expression

Shifting the emphasis from teaching to learning can create a more interactive and engaging learning environment for teachers and learners. This new environment also involves a change in the roles of both teachers and students. As shown in Table 1.2 (adapted from Newby et al., 2000), the role of the teacher will change from knowledge transmitter to that of learning facilitator, knowledge guide, knowledge navigator and co-learner with the student. The new role does not diminish the importance of the teacher but requires new knowledge and skills. Students will have greater responsibility for their own learning in this environment as they seek out, find, synthesize, and share their knowledge with others. ICTs provide powerful tools to support the shift to learning centered education and the new roles of teachers and students.

Table 1.2
Changes in Student and Teacher Roles in Learner-Centered Environments

A shift from:	***A shift to:***
Changes in Teacher's Role	
Knowledge transmitter, primary source of information, content expert, and source of all answers	Learning facilitator, collaborator, coach, mentor, knowledge navigator, and co-learner
Teacher controls and directs all aspects of learning	Teacher gives students more options and responsibilities for their own learning
Changes in Student Role	
A shift from:	***A shift to:***
Passive recipient of information	Active participant in the learning process
Reproducing knowledge	Producing and sharing knowledge, participating at times as expert
Learning as a solitary activity	Learning collaboratively with others

(Table adapted from one developed by Newby et al., 2000).

Instructional Role of Information and Communication Technologies

Information and Communication Technology alone, of course, does not produce learning; technology is a tool that can be used in many ways, to enhance learning. The literature generally describes three major categories of instructional use for computer-based technologies; these are: learning from the technology, learning about the technology and learning with the technology.

Learning from the technology

When technology is used to convey specific information or skills, Zucchermaglia (1991) describes it as "full" technology--full of information to be conveyed to the student. Maddux, Johnson, and Willis (1997) label applications that support this use as Type I applications, which are "designed to make it easier, quicker, or otherwise more efficient to continue teaching the same things in the same ways we have always taught them" (p. 18). Use of technology in this case mirrors traditional classroom practice: users are relatively passive, the content and interaction between the user and the software are predetermined, and there is a limited repertoire of acceptable responses. The acquisition of facts through repeated practice and rote memory, or learning from the technology (Jonassen, 1996), is the goal of instruction. This use of technology was the most prevalent one in the 1970s and 1980s (Jonassen, 1996).

"Full" or Type I technologies include computer assisted instruction, integrated learning systems, computer-based tutoring systems, assessment software, and administrative software, such as electronic grade books or attendance record- keeping software. Computer-assisted instruction and integrated learning systems have been readily adopted in many schools as they closely match the traditional routine of classroom life. McClintock (1992) points out that technology has often been used as a replacement for existing tools, such as books, rather than as an alternative medium through which different tasks might be performed and different objectives might be achieved. Some researchers (Vockell and Schwartz, 1992; Merrill, Tolman, Christensen, Hammons, Vincent, and Reynolds, 1986) suggest that computer-assisted instruction can increase achievement because it leads to automaticity of lower-level skills through extended practice. A computer that is endlessly patient with the learner monitors this practice. In the tutorial form of computer-assisted instruction, the computer provides additional information to the learner if an incorrect answer is supplied. This continues until the learner is successful.

Hundreds of research studies have been conducted regarding the effects of computer-assisted instruction (CAI). From his analysis of twelve meta-analyses of the effectiveness of computer-based instruction programs developed primarily prior to 1990, Kulik (1994) concludes that students usually learn more and in less time with computer-based instruction. Becker (1992), however, found numerous methodological problems with many studies that have demonstrated positive effects of using CAI. In his meta-analysis of 100 studies, he concludes that differences in CAI users and non-users are too small to have educational significance.

Learning about the technology

Another use of technology in schools that exemplifies traditional learning environments includes learning about the technology itself (Jonassen, 1996). Classes in computer programming and computer literacy are designed to teach students how computers work. Students learn specific skills related to using the computer, such as keyboarding skills, ethical uses of computers, or a particular programming language, but these skills are not tied to other content. These classes were prevalent in the 1980s, but Jonassen (1996) observes that this use of technology is now less emphasized in schools. He attributes the change to:

- the increasing availability of computers in society that gives students more experience with them outside of schools;
- the understanding that one does not have to know how a computer works to take advantage of it as a tool; and the
- emphasis on memorizing vocabulary about computers in computer literacy classes, which had little applicability to educational goals of schools.

Learning with the technology

Learning with technology drives much of the current thinking about the use of technology to support learning (Jonassen, 1996). Bonk, Hay, and Fischler (1996) note, "Currently popular ideas about students using electronic tools to be designers of knowledge are akin to Dewey's arguments that children must actively construct and interrelate knowledge by learning in more authentic ways" (p. 95). According to this perspective, when technology becomes an integral part of the classroom learning environment it provides a tool for both teachers and students that can facilitate new roles and new instructional strategies.

Technology used as a tool can serve as a means to seek and process information, and to reflect on one's understandings, beliefs, and thinking processes. Used in this way, technology is "empty" as it allows the learner to enter information and explore new content relationships (Zucchermaglia, 1991). Ordinary application software such as word-processing, spreadsheet, graphics, presentation, and database software; problem-solving software; simulations; electronic mail; and the Internet are technology tools that fit into this category. These applications, labeled Type II by Maddux et al. (1997), give the user control of almost everything that happens, including the interaction between the user and the machine. An extensive repertoire of acceptable responses is provided for. Rather than rote memorization of facts, Type II applications encourage the accomplishment of creative, higher-level tasks (Maddux et al., 1997).

Because of the interactive nature of technology and the power of its information-processing capabilities, Jonassen (1996) proposes that when students learn with technology, it becomes a "mindtool." He defines mindtools as "computer-based tools and learning environments that have been adapted or developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher-order learning" (p. 9). Using commonly available software (databases, spreadsheets, electronic mail, multimedia, hypermedia, and others), learners employ technology to both construct and represent knowledge.

Information and Communication Technologies in Teaching and Learning

The instructional implications of information and communication technologies are mostly based on Constructivist theory -- based on observation and scientific study -- about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences

Constructivism transforms the student from a passive recipient of information to an active participant in the learning process. Always guided by the teacher, students construct their knowledge actively rather than just mechanically acquiring knowledge from the teacher or the textbook. Students become engaged by applying their existing knowledge and real-world experience, learning to hypothesize, testing their theories, and ultimately drawing conclusions from their findings.

Changing roles of student, teacher and community

Students as Teachers

The age of the teacher as the primary source of knowledge in the classroom is gone. Today, with the universe of experts and information available through the Internet, students can access new and relevant information not yet discovered by their teacher. Internet-using educators are discovering a new mode of learning that we call "Side-by-side learning." It is becoming a more and more common experience to find students assuming both informal and formal roles as teachers of their peers and younger students, and in many cases of teachers.

Teacher as coaches

Teachers who involve their students in project-based learning activities also find their own role logically and naturally changing. Rather than being simple dispensers of knowledge, they discover their primary tasks are to guide and coach and mentor their students. They teach their students how to question, and how to develop hypotheses and strategies for locating information. They become co-learners as their students embark on a variety of learning projects, which chart unfamiliar territory.

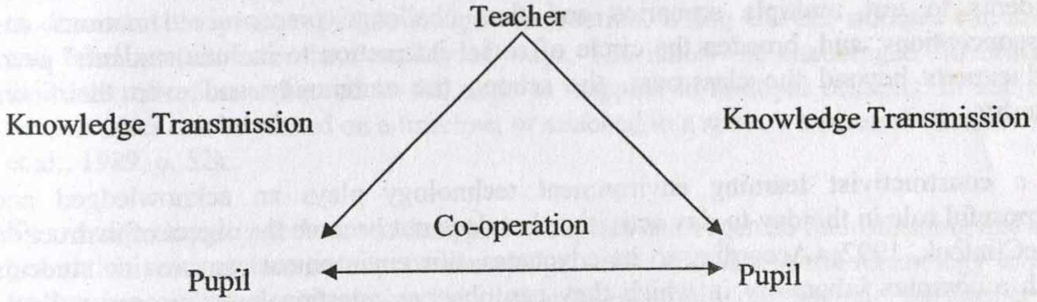
Community as guide and mentor

With the growth of the World Wide Web, more and more of "the community" can be found online, therefore permitting closer relationships between people inside schools and outside in the "real world". Parents, business leaders, scientists, political leaders and administrators, and many other members of the community can play more effective and innovative roles as motivators, role models, sources of information, critics, evaluators, guides, and mentors.

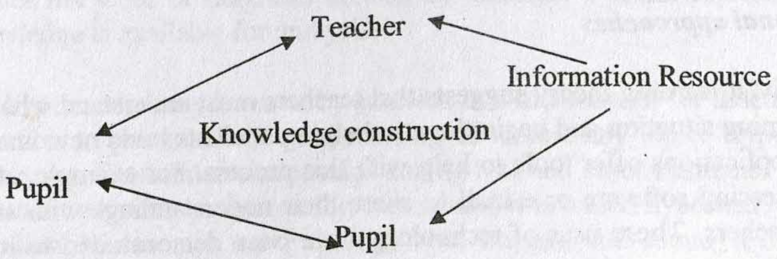
The changing role of teacher in ICTs based interactive learning

In the traditional teaching learning situation, the relation between the teacher and the pupil is frontal –the role of the teacher is to deliver knowledge to the pupil. There is some co-operation among pupils. Teachers do not possess adequate knowledge and skills for the effective exploitation of ICTs. In many cases teachers are less expert than their pupils. Further, teachers find themselves in a situation where they are no longer the principal source and deliverer of information. In this context, teachers need to be properly trained for developing pupils' learning abilities. The skills needed how to use computers as tools for learning i.e. develop a critical mind; how to make lines among different sources and types of information; and how to help pupils to construct their knowledge with ICTs.

Traditional Teacher pupil relationship



Teacher pupil relationship in emerging learning society



For effective education, it is essential that there be more opportunities for student participation in the learning process, more team work, more self-study and self-evaluation, as well as more peer evaluation and less examination oriented teaching and learning. It is felt that ICTs can assist in promoting more student centered and interactive learning.

The new technologies have enormous potential to revolutionize education. It is obvious that the monopolies enjoyed by schools as formal education providers will diminish.

What the teacher has to do in a learning centered classroom?

Teacher has to use many techniques in the teaching process. For example, he may:

- prompt students to formulate their own questions (inquiry)
- allow multiple interpretations and expressions of learning (multiple intelligences)
- encourage group work and the use of peers as resources (collaborative learning)

The literature suggests that technology can support constructivist learning environments when technology is used as a tool for learning, rather than the object of instruction or as the instructor, it can assist the teacher to uncover students' prior knowledge, understanding and beliefs; base instruction on the posing of problems; increase the complexity of the context; take on the role of the facilitator; increase the ability of students to test multiple scenarios and thus challenge preconceived notions and misconceptions: and, broaden the circle of social interaction to include students' peers and experts beyond the classroom, the school, the community and even their own country.

In a constructivist learning environment technology plays an acknowledged and purposeful role in the day-to-day activities, but does not become the object of instruction (McClintock, 1992). According to its advocates, this environment can provide students with a complex laboratory in which they can observe, question, practice, and validate knowledge. The following discussion examines how technology can be used to support the creation of classroom environments based on the instructional implications of constructivist learning theory. This discussion is based on the premise that it is learning with, not from or about, technology that makes computer-based technologies important tools in a constructivist learning environment.

Instructional approaches

Constructivist learning theory suggests that teachers must understand what learners bring to the learning situation and begin there in helping students build new knowledge. Basic, Type II applications offer tools to help with this process. For example, students can use word-processing software or e-mail to share their understandings with student peers as well as teachers. These uses of technology have been demonstrated to improve writing skills, produce more and better ideas for decision making, and increase motivation (Center for Applied Special Technology, 1996; Chun, 1994; Cohen and Riel, 1989; Honey and Henriquez, 1996; Mabrito, 1992; Moore and Karabenick, 1992; Naiman, 1988; Olaniran, 1994).

Technology can help to make students' thinking processes more visible to the teacher, something that does not happen when students simply turn in a completed assignment for checking and grading. As teachers observe their students working with computer applications, they can see the choices each student is making, stop and ask about the student's goals, and make suggestions for revisions or different strategies (Means and Olson 1997, p. 126-127).

One technology particularly suited to this process is Computer Supported Intentional Learning Environments (CSILE), developed by researchers at the Centre for Applied Cognitive Science (Ontario Institute for Studies in Education). CSILE is a software-based tool that provides a means for students to build a collective database (knowledge-base) of their thoughts, in the form of pictures and written notes. CSILE stores the thoughts entered by each student and makes them available for everyone . . . . The system is a form of hypermedia that allows notes entered as text, drawings, graphs, and timelines to be retrieved, linked, commented on, rated, and so forth. (Scardamalia, Bereiter, McLean, Swallow, and Woodruff, 1989, p. 52)

Students enter what they already know about a topic at the beginning of the creation of a CSILE database. This provides a tool for the teacher both to identify prior knowledge and to document the process of knowledge construction. Using CSILE, students can create and label written notes in a variety of ways. The labels are encouraged "in order to facilitate reflection and to allow the notes to reappear in multiple contexts. In addition, written notes can be placed on a timeline, or attached to a spot on a picture" (Scardamalia et al., 1989, p. 52).

Knowledge mapping software is designed to capture and organize brainstorming and idea generation sessions into concept or knowledge webs. This is a useful technology to help teachers uncover students' existing knowledge about a topic. For example, the teacher can pose a problem or suggest a content topic to students. Using the software, students can create a diagram of ideas, consisting of one or a few words, connected by "links," which may be lines or arrows or a text label. These webs of ideas may be linked to other webs, links may be changed easily, and notes may to be added to each idea in the web. All of these elements may also be converted to an outline format (Neuburg, 1997). As the teacher examines the webs or diagrams created by students, a visual representation of their prior knowledge is available for analysis.

Hypertext and hypermedia may be used by students in a like manner for assembling and linking information to present their understanding of almost any topic. Hypermedia is software built on non-linear interrelationships among text and other elements. When text is linked to related text using programming commands, it is called hypertext. By adding elements that allow the user to move through text, images, and sound, a hypermedia environment is created. Hypertext and hypermedia are structured so that the user accesses information in ways that are meaningful to him or her (Jonassen, 1996) rather than through a linear presentation. As students create hypermedia stacks, their existing knowledge is represented.

Simulation software also offers an opportunity for uncovering and examining student prior knowledge. "Simulations put the student in an active role in an environment that has a set of rules" (Maddux, et al., 1997, p. 219). As a student begins to interact with a simulation, prior knowledge guides the choices s/he makes when selecting from the options offered. Observing the choices made as the student begins the simulation and discussing the reasons for those choices provides a rich opportunity for both the teacher and the student to explore the student's prior knowledge.

In addition to the prior knowledge and understanding students bring to the learning situation, they also bring interests. As noted previously, teachers who create learning environments that enable the learning process structure activities that build on students' current interests. Technology can be used to help identify those interests. Allowing students to create hypermedia stacks or to use knowledge mapping software to create idea webs about self-selected topics can provide teachers a clearer picture of students' interests.

Once student interests and prior knowledge are identified, teachers guided by constructivist learning theory base learning experiences on both. Often, however, teachers cannot respond to the multitude of student interests due to lack of resources available in the classroom or the school. Technology can provide access to resources that build on students' interests (Irving, 1991; Riel, 1994; Swan and Mitrani, 1993). Databases of information available on CD-ROM or on the Internet, however, allow students to examine a multitude of topics that may be of unique interest to an individual student (McDaniel and McInerney, 1992).

Means and Olson (1997) found technology can support teachers' efforts to engage students in long-term, complex projects by dramatically enhancing student motivation and self-esteem, making obvious the need of longer blocks of time, creating a multiplicity roles, leading to student specialization in different aspect of technology use, instigating greater collaboration, and giving teachers additional impetus to take on a coaching and advisory role. Numerous other studies have demonstrated the increased motivation and engagement of students when they use technology (Dimock, 1996; Deal, 1995; Ferneding-Lenert and Harris, 1994; Harasim, 1989; Lowry et al., 1994; Mason, 1989; Moore and Karabenick, 1992; Ross et al., 1990; Ryser et , 1995; Sandholtz et al., 1997; Velayo, 1993; Williams, 1995). One study, focused on students with limited English proficiency (LEP) who used videodiscs as part of instruction over a three year period, reported that these students had significantly stronger agreement with statements such as: "I like my science class," "We do fun things in science," "My friends like science," and "I would like to take more science" than LEP students in conventional classrooms (Barrutia, Bissell, Rodriguez, and Scarcella, 1993).

Impact of collaboration in technology based collaborative learning

The impact of collaboration in technology based collaborative learning environments on study performance and nature and quality of knowledge construction has been studied during four subsequent years (Schellens, 2004; Schellens and Valcke,2000,2002, Schellens, Van Keer, and Valcke, 2004a, 2004b, reported by Valcke, M. *et al.* 2005)

In the first study, 300 of 850 freshman students studying psychology and educational sciences participated. They worked four months in 38 asynchronous discussion groups on authentic task and problems in which they applied the theoretical base of different instructional theories. Group size was manipulated this study. The complete transcripts of nine groups were analyzed to determine levels of knowledge construction reflected in these messages. The results of this study confirm the task related nature of the group communication. Building on the hypothetical hierarchical nature in the levels of knowledge construction, the results further reveal higher proportions of phases of knowledge construction in all groups. As to the group size, smaller groups (8-10 students) reached significantly higher levels of knowledge construction than average size (11-13) and large groups (15-18).

In a subsequent study, 230 freshmen worked in 23 asynchronous discussion groups as a formal part of their curriculum. Group size was constant in this study (10 per group) and the focus was on determining the impact of task structure (Global task versus pre-structured task) and participation levels (three levels, based on the number of observed contributions in the group discussions) on construction. Complete transcripts of eight randomly selected discussion groups were analyzed. The results again confirm the highly task oriented nature of the discussions. Discussions in more actively engaged groups (reflecting the highest participation level) show significantly higher level of knowledge construction. The findings also hint at a significant impact of task structure. More complex tasks foster higher levels of knowledge construction.

In the third study, with 286 students, multi-level analysis was applied to determine the impact of individual student characteristics (i.e., positive attitude towards collaborative learning; deep, surface, or strategic learning style; participation level). And task characteristics (i.e., role assignment, task complexity) on two dependent variables, namely level of knowledge construction and study performance. To determine the level of knowledge construction, the same models were applied to code the transcripts as in the second study. With respect to the in-depth exploration to the task environment, task complexity (availability of conceptual base and availability of a solution procedure) was measured and considered to have a differential impact.

The results of this study point at the impact of task complexity. When tasks are too complex, the levels of knowledge construction are significantly lower. On the other hand, when the tasks are too straightforward, the number and quality of constructions drop significantly. The results confirm the earlier findings that a task should be in the learners' zone of proximal development (Schellens *et al.*, 2004a; Quinn, 1997). With respect to the impact of roles, only the role of the 'summarizer' resulted in significantly higher levels of knowledge construction. Considering the results of the multi-level analysis dealing with student, group, and task variables, a large part of the overall variance in students' level of knowledge construction can be attributed to differences between the various discussion themes and tasks. As to the impact of student characteristics, the amount of individual contributions and students' attitude towards the online learning environment are significant predictors of students' mean level of knowledge construction.

The findings of the above studies are largely in line with the results of studies that fit into the long tradition of collaborative and cooperative learning research (Johnson and Johnson (1994) and Slavin (1995). The research results reveal that task structure is an important issue to consider for developers of such environments. A careful balance should be respected between open and closed structure of discussion. Along with task structure, task complexity is also a significant factor. Tasks should not be too complex as students' motivation might decline. Illera (2001) states that motivation also implies that students are capable of seeing that they can complete the activity that is within their zone of proximal development and that it is something unattainable. On the other hand, when tasks are too straightforward, we might expect that students experience no challenge and that the quality of contributions also drops. It appears that challenge is an important concept in this context. In order to keep the learning in this zone of proximal development, focus should be laid on structuring of assignment. Another practical implication is that task should be enjoyable.

These strategies are consistent with constructivist approaches to learning and instruction to foster engagement in an online learning environment. Present achievable goals and clear evaluation criteria, organize authentic learning, and set tasks at the appropriate level of complexity.

Conclusion

It may be concluded that it is learning with, not from or about, technology that makes computer based technology an important tool in a new paradigm of learning. In order to capitalize on the potential of new technology, and particularly digital technology as a teaching tool there is an urgent need of the professional development of teachers. Professional development that allows teachers to construct professional knowledge about pedagogy, content, and technology, as well as strategies for managing the changing classroom environments brought about with the creation of constructivist learning environments supported by technology. To achieve this, there is need of providing learning experiences to the teachers. These experiences should be situated in an authentic context for teachers, their school and classroom. It should build on their prior knowledge and provide opportunities for social interaction with colleagues. It should begin with investigation of problems supported by technology that are relevant to teachers. By providing such learning experiences to the teachers, we can enable them to create learning experiences appropriate for the children of the Information Age and take the advantage of Information and Communication Technologies in a new paradigm of learning.

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WHY CONSTRUCTIVISM?

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From the broad framework it is clear that while teaching any subject one teaches 'CONCEPT', 'DEFINITION' AND 'INTERRELATIONS'. Interrelations could be between concepts, between definitions and between concepts and definitions .Interrelations could be 'Conceptual', like, 'Bat is mammal' .or it could be mathematical like Force=(Mass)×(Acceleration),or, $(a + b)^2=a^2+2ab+b^2$.Let us focus our attention on 'CONCEPT' as they form the foundation.

Pre-1960 Scenario

Prior to 1960 the conventional approach to teaching learning is based on the following premises.

- Each concept has a unique ,objective existence ,i.e. ,any concept, say ,'velocity', has a unique definition ,connotation ,form of application and use .This uniqueness is independent of the teachers and pupils .Hence it has also an objective existence
- Concept to be taught and learnt at a particular level are enshrined in the curriculum which is designed by expert taking into account the perceived needs of the students and the statutory requirements of the affiliating Boards/Universities.
- Concepts, contained in the curriculum, are described and discussed in the Textbook.
- The teacher's job is to transact these concepts in the class-room.
- The pupil's responsibility is to receive them.

In this method the concepts with their unnegotiable uniqueness were held supreme and the pupils are more or less like toys which dance to the dictates of external tunes. In this framework the characteristics of the class-room transaction are the following.

- The teacher knows everything and the pupils do not know anything.
- The teacher lectures and the pupils listen.
- The teacher demonstrates and the pupils observe.
- The teacher asks questions and the pupils answer them.
- The teacher enforces his authority and the pupils obey it.
- The teacher can punish (some times for wrong reasons) by imposing his authority of knowledge and the pupils are to tolerate the punishment as meek lambs.

- The teacher acts and the pupils are to show as if they are also taking part in the acting.

This method of teaching is called the Teacher –Centered Approach .In this method.

- Learning is regarded as passive process, like, filling in an empty pot.
- No where any concern is shown for the pupil.
- Because of the above, a state of alienation is induced in the mind of the pupil.
- As a result, the pupil sits in the class but does not belong to the class.

Is this not a very peculiar teaching –learning situation? It is, as if, the teacher brings an apple and orders the pupils to eat it. The pupils has to eat even he does not like apple, If he eats the apple with even a false smile on his lips as if he is enjoying it, he is called a good student, if he voices that he does not like an apple and also does not eat it, he is branded as a bad student. In India, this situation still exists in many schools.

Scenario during 1960-1980

In 1957 Russia sent to space SPUTNIK-1 and became the first country to achieve this. Observing this the western world woke up with a start and asked – "what is wrong with our teaching of science''? They were at least sure that Teacher –Centered Approach is not delivering the goods. So they searched for alternative approaches. They came across the works of the cognitive psychologists. To name a few, they were Piaget, Bruner and Ausubel.

Piaget: Through extensive and intensive empirical evidences he proposed that the mental growth of a child goes through 4 discernable stages; Stage -0, Stage-1, Stage-2, Stage-3.Each stage is characterize by clear mental and logical abilities .Thus if a child is in Stage-1, say, and is exposed to a concept, the cognitive demand of which is in Stage -2, then the child will never be able to learn that concept. Thus for improving the quality of learning there should be a match between the mental stage of the child and the cognitive demand of the concept, to be learnt.

He also proposed that learning by a child goes through three steps, Assimilation, Accommodation and Equilibration.

Bruner; He for the first time identified the characteristics of a concept .According to him, a concept has (1) Name, (2) Examples with (Both positive and negative), (3) Attributes (Essential and non–essential), (4) Attributes Attainment Model which is different from the Concept Assimilation Model, then in vogue .One of the salient feature s of Bruner's model was that a child is said to have attained a concept it he can apply the concept in unfamiliar situations and arrive at valid conclusions.

Ausubel: He tried to understand the learning process. He argued that if one wants to learn, say, 'Clock' (which is a concept), one can start with the components, and then go on gradually compiling them, integrating then till one builds the clock (the process of integrative reconciliation), or, one can take a clock, dismantle it gradually till reaches as its basic components (the process of progressive differentiation).He also proposed his Advance Organizer Model.

The Westerners also discovered a Chinese proverb which says – **'I read I forget, I see, I remember, I do understand'.** The last part of this proverb advocates the Activity –based approach.

Based on the findings of the cognitive psychologists and the importance of the activity –based approach, new text-book was written. This resulted in the PSSC (Physical Science Study Committee) & BSSC (Biological Science Study Committee) text book in America and Nuffield Science text book. These books were immediately implemented with the hope that there will be a large quantum jump in the degree and quality of learning science by the pupils.

This approach is known as the Learner–Centered Approach because here the pupils occupied the centre stage is so far drafting the books and transacting then was concerned.

Post-1980 Scenario

By 1980 impact study were undertaken and the findings are the following

- There is marginal improvement in the degree and quality of learning.
- I do and I am more confused.

Naturally the western world was shocked with these findings and stated asking new questions and searching new methods of teaching .They suddenly realized that in a teaching –learning process, the teacher is not important ,the learner is not important ,but what is important is the learning out come, because that ultimately measures the degree of success of the process.

In their search they came across a very important and loaded statement of Ausubel, where he states-

"If you ask me to identify the single most important factor which determines the degree and quality of learning I will say, ascertain what the child knows and teach him accordingly".
This statement has two parts.

Part-I: Ascertain what the child knows.

Part–II: Teach him accordingly.

So extensive and intensive research started on the Part-I of the statement .Some of the critical findings are the following.

Concept of ANIMAL

After the teaching on the classification of living beings as plants and animals was completed the pupils still have the concept that:

- Human beings are not animals.
- Mosquito and grasshopper are not animals, and
- Even parrot and crow are not animals.

For them 'ANIMAL' is characterized by 4 legs ,tails ,and big size .This concept about the concept 'Animal' is true and valid for them because they use the teem 'Animal' only in this context .We may say that such a connotation of 'Animal' is wrong .But this is the connotation for the user ,the learner .

Thus a concept no longer has a unique objective meaning .A concept now assumes pluralistic meaning.

Concept of Living

In a test conducted in a class about 40 percent of the pupils replied that 'Fire 'is a living being .O n discussion with them they put forward the argument that –

Fire can create fire,

- Fire can move from one place to another
- Fire respires oxygen
- Fire needs food (i.e. paper, leaves, wood) for survival.
- Fire responding to stimulus .if one at fire, flashes comes out.

So, 'Fire' is a living being.

Few more examples are:

- Pupils feel that their images in a plane mirror are real images.
- A body at rest has no force acting on it.
- When a stone is through up, during its upward motion, an upward directed force is acting on it.
- The increase in mass of an iron nail due to rusting is a physical change.
- Temperature is the amount of heat in a body.
- One kg. of potato is heavier than one kg. of bringle .
- Rivers start from the ocean and fall in hills.
- If a child is standing and his extended left hand points East, his extended right hand points west, then the upward direction is north.

From tens of thousands of such research studies the following conclusions are arrived at.

- No child enters a class devoid of concepts.

- Concepts cannot be instructed.
- Every child constructs his /her knowledge on the basis of his/her past knowledge, experiences and concepts.
- The personal concept of a child about any concept is very much true and valid for him /her and may be totally different from the scientific meaning of it. We may call this personal concept of the child as his/her 'Alternative Conception or ALCON.
- ALCONs control the degree and quality of knowledge construction and hence degree and quality of meaningful learning.
- ALCONs offer resistance for modification
- All the teacher can do is to help the child construct his/her concept about a concept in a way the teacher expects the child to construct.
- Thus conventional teaching has to be replaced by a process of negotiation through cognitive apprenticeship.

This then is called the Constructivist Approach to teaching and learning .In this approach the teacher is no longer,

- A ring master but an equal stage –player ,
- A director but an actor ,
- An instructor but a facilitator ,and
- The sole organizer but an equal partner.

A teaching model to take these ideas into a class room consists of the following six steps:

1. Create a situation such that the pupils **Voice** their ALCONs
2. Find out the zone of **Overlap** between the ALCONs and the concept you are going to teach.
3. Create a state of Interaction between the pupils so that each will try to defend his/her ALCONs and at the end the wrong ALCONs will get eliminated.
4. **Choose** a suitable technique to introduce the concept you want to teach.
5. **Enunciate** the concept with examples and non-examples. Choose such examples which
   are likely to be confused examples.
6. With suitable test "**satisfy** "yourself that the pupils have constructed the concept in the way, you want them to construct interaction.

In these task six steps the key words have been underlined .If you take the first letter of these six key words you get ,VIOCES' .Thus this model is called the VOICE' model and rightly so because it takes cognizance of the voices of the pupils in the form of their ALCONS. It can be now realized that although 'Concepts cannot be instructed 'the role of a teacher in the Teaching –Learning process has become more demanding in this constructivist approach.

As always, it is also now very easy to become a teacher ,because there is still no on–the –spot accountability .However, to become a good teacher it is now all the more difficult .A good teacher is expected to have the following abilities .

- Exceptionally good content knowledge.
- The organizing ability of an executive
- The commitment of a surgeon.
- The friendly approach of a sales person.
- The human understanding of psychiatrist.
- The audience contact of an actor.
- The negotiating ability of a politician.
- The ability to execute all these abilities in a class room situation.

It is now time to introspect and see how many of these abilities each of us has.

INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY INTO CONSTRUCTIVIST LEARNING ENVIRONMENT

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ABSTRACT

The constructivist revolution offers a new vision of the learner as an active sense-maker and suggests new methods of instruction. It facilitates presentation of materials in a constructivist way and engage students in an active explorative learning. This new approach allows the learners to have more control over their own learning to think analytically and critically, and to work collaboratively. This constructivist approach is an effort at educational reform made easier by technology. In this process the learner has access to global rather than local software and maintains a direct link to the teacher. This interactivity may take the form of a direct e-mail link, electronic conferencing or an automated connection to a server programme. This is a revolutionary vision of education. In view of the above here in this paper an attempt has been made to integrate digital technology into constructivist learning environment for effective learning.

In recent years we have seen the birth of Information Age. The Information Age has largely been made possible by the advent of digital technology, and it has resulted in an explosion in number of sources of information and images, which are available to us. But the world of education and teaching in particular has not taken the advantage of these changes. We have largely failed to capitalize on the potential of the new technologies, and particularly digital technology as a teaching tool.

Our education system must respond to the transformations that are being brought by technology, digital technology in particular. Such technology has the ability to revolutionize the way our children and we learn and also can revolutionize the whole teaching learning system.

As society moved from the Industrial Age to the Information Age, the technology was applied to teaching. Visual presentation moved from the chalk-board to transparency projectors, media moved from filmstrip to video, and access to internet enhanced communication worldwide. But it is important to keep in mind that this technology is merely a learning medium. It can ever be a bridge, never a destination. Computers may help the students learn but it cannot make the students learn. It is the imagination and creativity of the professionals within education and the digital world that will determine the pace and the quality of change. In this new age of digital technology the creativity and the imagination of teachers will remain as critical as they have always been. If learning is the heart of new digital world then teacher its lifeblood. In fact the teacher, not the technology is the key to the future. Without good teachers we have no future.

A good teacher needs to have the ability to inspire and arouse curiosity and need to be a coach, colleague and friend. It is feasible only in a constructivist-learning environment. Constructivism implies that effective learning does not occur when students read a chapter, listen to a lecture, take notes and prove their knowledge in a testing situation. Real learning occurs when student investigate a concept, find information, discuss it and create something with it. The integration of technology facilitates this investigation, discussion and creation; it allows the teacher to be the guide. Students become empowered and spend more time in active construction of knowledge when using technology. Technology provides more resources for student use in problem solving, thinking and reflection. Students spend more time collaborating with other students and communicating with teachers.

What is Constructivism?

Constructivism is basically a theory -- based on observation and scientific study -- about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences

In the classroom, the constructivist view of learning can point towards a number of different teaching practices. In the most general sense, it usually means encouraging students to use active techniques to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing.

Constructivism does not dismiss the active role of the teacher or the value of expert knowledge. Constructivism modifies that role, so that teachers help students to construct knowledge rather than to reproduce a series of facts. The constructivist teacher provides tools such as problem-solving and inquiry-based learning activities with which students formulate and test their ideas, draw conclusions and inferences, and pool and convey their knowledge in a collaborative learning environment. Constructivism transforms the student from a passive recipient of information to an active participant in the learning process. Always guided by the teacher, students construct their knowledge actively rather than just mechanically acquiring knowledge from the teacher or the textbook. Students become engaged by applying their existing knowledge and real-world experience, learning to hypothesize, testing their theories, and ultimately drawing conclusions from their findings.

Our past experiences about learning

Mayer (1992) has shown how three views of learning have emerged during the past 100 years of research on learning **(i) learning as response strengthening (ii) learning as knowledge acquisition (iii) learning as knowledge construction**. According to the first view, learning occurs when learner strengthens or weakens an association between a stimulus and a response. This first view i.e. **learning as response strengthening** developed in the first half of 20th century and was based largely on the study of animal learning in artificial laboratory settings. The role of learner is to passively receive rewards and punishments, whereas the role of instructor is to administer rewards and punishments, such as drill-and-practice. The instructional designer role is to create environments where the learner repeatedly is cued to give a simple response, which is immediately followed by a feedback.

The second view, **learning as knowledge acquisition** is based on the idea that learning occurs when a learner places new information in long-term memory. This view developed in 1950s, 1960s and 1970s and was based largely on the study of human learning in artificial laboratory settings. The role of the learner is to passively acquire information, and the teacher's job is to present information, such as in textbooks and lectures. According to this view, information is a commodity that can be transmitted directly from teacher to learner. The instructional designer's role is to create environments in which the learner is exposed to large amount of information through textbooks, lectures and computer based multimedia programmes.

The third view, **learning as knowledge construction**, is based on the idea that learning occurs when a leaner actively constructs a knowledge representation in working memory. This view emerged in 1980s and 1990s and was based on largely on the study of human learning in increasingly realistic settings. According to this view, the learner is a sense maker, whereas the teacher is a cognitive guide who provides guidance and modeling on authentic academic tasks. The instructional designer's role is to create environments in which the learner interacts meaningfully with academic material, including fostering the learner's processes of selecting organizing and integrating information.

How constructivism is different from traditional ideas about teaching and learning?

The classroom is no longer a place where the teacher pours knowledge into passive students, who wait like empty vessels to be filled in. In the constructivist model, the students are urged to be actively involved in their own process of learning. The teacher functions more as a facilitator who coaches, mediates, prompts, and helps students develop and assess their understanding, and thereby their learning The table below compares the traditional classroom to the constructivist one.

Traditional Classroom	**Constructivist classroom**
Curriculum begins with the parts of the whole. Emphasizes basic skills	Curriculum emphasizes big concepts, beginning with the whole and expanding to include the parts
Strict adherence to fixed curriculum is highly valued	Pursuit of student questions and interests is valued
Materials are primarily textbooks and workbooks	Materials include primary sources of material and manipulative materials
Learning is based on repetition.	Learning is interactive, building on what the student already knows
Teacher's role is directive, rooted in authority	Teacher's role is interactive, rooted in negotiation
Assessment is through testing, correct	Assessment includes student works,

answers	observations, and points of view, as well as tests. Process is as important as product.
Knowledge is seen as inert	Knowledge is seen as dynamic, ever changing with our experiences
Students work primarily alone	Students work primarily in groups

What the constructivist teacher has to do in his classroom?

Constructivism teacher has to use many techniques in the teaching process. For example, he may:

- prompt students to formulate their own questions (inquiry)
- allow multiple interpretations and expressions of learning (multiple intelligences)
- encourage group work and the use of peers as resources (collaborative learning)

Its primary goal is helping students learn *how to learn.*

In a constructivist classroom, learning is:

Constructive: Students are not blank slates. They come to learning situations with already formulated knowledge, ideas, and understandings. This previous knowledge is the raw material for the new knowledge they will create.

Active: The student is the person who creates new understanding for him/herself. The teacher coaches, moderates, suggests, but allows the students to experiment, ask questions, try things that don't work. Learning activities require the students' full participation (like hands-on experiments). An important part of the learning process is that students reflect on, and talk about, their activities. Students also help set their own goals and means of assessment.

Reflective: Students control their own learning process, and they lead the way by reflecting on their experiences. This process makes them experts of their own learning. The teacher helps create situations where the students feel safe questioning and reflecting on their own processes, either privately or in group discussions. The teacher should also create activities that lead the student to reflect on his or her prior knowledge and experiences. Talking about what was learned and how it was learned is really important.

Collaborative: The constructivist classroom relies heavily on collaboration among students. The main reason it is used so much in constructivism is that students learn about learning not only from themselves, but also from their peers. When students review and reflect on their learning processes together, they can pick up strategies and methods from one another.

Inquiry based: The main activity in a constructivist classroom is solving problems. Students use inquiry methods to ask questions, investigate a topic, and use a variety of resources to find solutions and answers. As students explore the topic, they draw

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conclusions, and, as exploration continues, they revisit those conclusions. Exploration of questions leads to more questions.

Evolving: Students have ideas that they may later see were invalid, incorrect, or insufficient to explain new experiences. These ideas are temporary steps in the integration of knowledge. For instance, a child may believe that all trees lose their leaves in the fall, until he/she visits an evergreen forest. Constructivist teaching takes into account students' current conceptions and builds from there.

History of Constructivism

The concept of constructivism has roots in classical antiquity, going back to Socrates's dialogues with his followers, in which he asked directed questions that led his students to realize for themselves the weaknesses in their thinking. The Socratic dialogue is still an important tool in the way constructivist educators assess their students' learning and plan new learning experiences.

Jean Piaget and John Dewey developed theories of childhood development and education, what we now call Progressive Education that led to the evolution of constructivism.

Piaget believed that humans learn through the construction of one logical structure after another. He also concluded that the logic of children and their modes of thinking are initially entirely different from those of adults. The implications of this theory and how he applied them have shaped the foundation for constructivist education. Dewey called for education to be grounded in real experience. Inquiry is a key part of constructivist learning.

Among the educators, philosophers, psychologists, and sociologists who have added new perspectives to constructivist learning theory and practice are Lev Vygotsky, Jerome Bruner, and David Ausubel.

Vygotsky introduced the social aspect of learning into constructivism. He defined the "zone of proximal learning," according to which students solve problems beyond their actual developmental level (but within their level of potential development) under adult guidance or in collaboration with more capable peers. Bruner initiated curriculum change based on the notion that learning is an active, social process in which students construct new ideas or concepts based on their current knowledge. Ausubel introduced the concept of meaningful learning, which constitutes an important part of constructivist learning.

Seymour Papert's groundbreaking work in using computers to teach children has led to the widespread use of computer and information technology in constructivist environments.

Modern educators who have studied, written about, and practiced constructivist approaches to education include John D. Bransford, Ernst von Glasersfeld, Eleanor

Duckworth, George Forman, Roger Schank, Jacqueline Grennon Brooks, and Martin G. Brooks.

Some critical perspectives of Constructivism

Constructivism has been criticized on various grounds. Some of the charges that critics level against it are:

It's elitist. Critics say that constructivism .and other "progressive" educational theories have been most successful with children from privileged backgrounds who are fortunate in having outstanding teachers, committed parents, and rich home environments. They argue that disadvantaged children, lacking such resources, benefit more from more explicit instruction.

Social constructivism leads to collaboration. Critics say the collaborative aspects of constructivist classrooms tend to produce a "tyranny of the majority," in which a few students' voices or interpretations dominate the group's conclusions, and dissenting students are forced to conform to the emerging consensus.

There is little hard evidence that constructivist methods work. Critics say that constructivists, by rejecting evaluation through testing and other external criteria, have made themselves unaccountable for their students' progress.

Benefits of constructivism

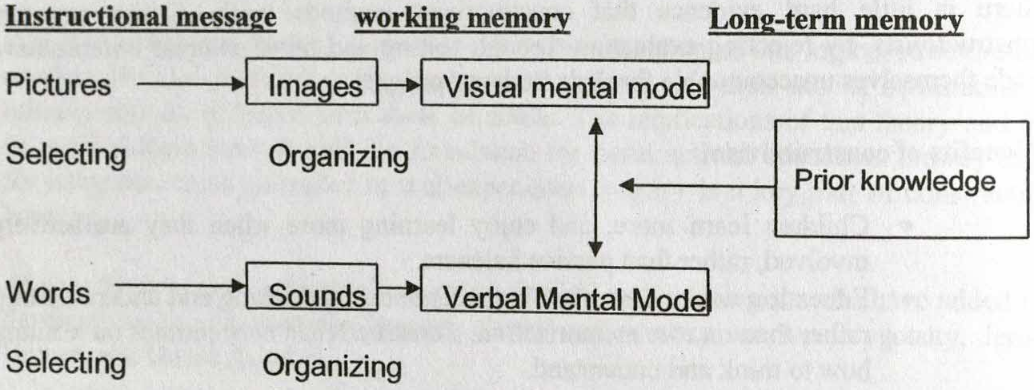
- Children learn more, and enjoy learning more when they are actively involved, rather than passive listeners.
- Education works best when it concentrates on thinking and understanding, rather than on rote memorization. Constructivism concentrates on learning how to think and understand.
- Constructivist learning is transferable. In constructivist classrooms, students create organizing principles that they can take with them to other learning settings.
- Constructivism gives students ownership of what they learn, since learning is based on students' questions and explorations Engaging the creative instincts develops students' abilities to express knowledge through a variety of ways. The students are also more likely to retain and transfer the new knowledge to real life.
- By grounding learning activities in an authentic, real-world context, constructivism stimulates and engages students. Students in constructivist classrooms learn to question things and to apply their natural curiosity to the world.
- Constructivism promotes social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas. Students must learn how to articulate their ideas clearly as well as to

collaborate on tasks effectively by sharing in group projects. Students, therefore, exchange ideas and so learn to negotiate with others and to evaluate their contributions in a socially acceptable manner. This is essential to success in the real world, since they will always be exposed to a variety of experiences in which they will have to cooperate and navigate among the ideas of others.

Model to highlight the three crucial processes in constructivist learning

Constructivist learning depends on the activation of several cognitive processes in the learner during learning, including selecting relevant information, organizing incoming information, and integrating incoming information with existing knowledge. This is called as the **SOI model** to highlight three crucial cognitive process in constructivist learning: S for selecting, O for organizing, and I for integrating (Mayer, 1996). Constructivist theory focuses that knowledge is constructed by the learner in working memory. In this construction process the learner used both incoming material from the environment and prior knowledge from long-term memory. The SOI model is a theory of learning that can be used to generate instructional implications.

SOI model



Selecting relevant information: The first process is the selection of relevant information for further processing. When words and pictures are presented to learn in an instructional message, the learner represents them briefly in sensory memories, because of the limited capacity of the human information-processing system. Only some of these representations can be retained for further processing in working memory.

Organizing incoming information: The next process involves organizing the selected auditory representation into a coherent verbal representation and organizing the selected images into a coherent pictorial representation. In this process the retained visual images are connected by appropriate links (such as cause and effect) and retained verbal representations are connected by appropriate links (such as cause and effect). This activity takes place in working memory. The outcome of this process is the construction of a coherent pictorial representation and a coherent verbal representation.

Integrating incoming information: In the third process, students make one-to-one connections between corresponding elements of the pictorial and verbal representations they have constructed using prior knowledge.

A final step in learning process is encoding, in which the mental representations constructed in working memory are stored in long-term memory for permanent retention.

Internet technology and Constructivist Learning

Internet technology has made a substantial contribution to education. The emphasis now continues to shift from Computer Based Learning (CBL) and its related methods such as Computer Assisted Instruction (CAI) to Internet Based Learning.

There appear to be two main options. One is a form of distance learning in which a teacher places course-materials on a web server, which can be accessed by remote students. This approach follows a prescriptive pattern. It allows all the teaching materials to be validated at source and integrated into the course. However, it may be an expensive way to provide enough software to meet the demands of complete syllabus. The alternative is a type of independent study in which learners search the internet for material that are relevant to their interests. This is a more constructive process that can provide access to a media range of course-ware and multiple views of a subject area but the suitability of the material for a taught course cannot be guaranteed.

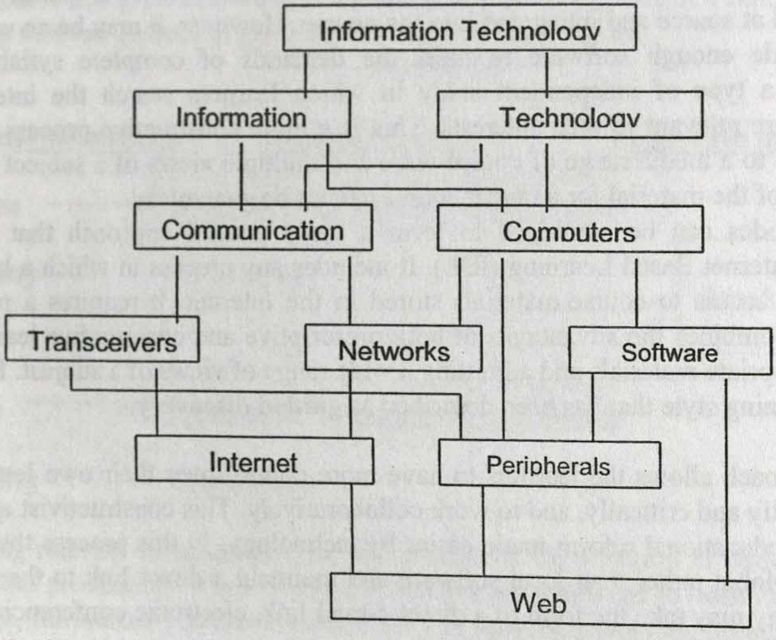
These two modes can be combined to form a more general approach that may be described as Internet Based Learning (IBL). It includes any process in which a learner is provided with access to course-materials stored in the Internet. It requires a model of teaching that combines the advantages of both prescriptive and constructive learning by selecting appropriate materials and admitting a wide range of views of a subject. It should facilitate a learning style that has been described as **guided discovery**.

This new approach allows the learners to have more control over their own learning to think analytically and critically, and to work collaboratively. This constructivist approach is an effort at educational reform made easier by technology. In this process the learner has access to global rather than local software and maintain a direct link to the teacher. This interactivity may take the form of a direct e-mail link, electronic conferencing or an automated connection to a server programme.

Internet information is usually accessed through the hypertext protocols of World Wide Web. Some authors are of the opinion that an unstructured presentation is more conducive to learning by forcing the learner to construct a personal knowledge map. Other prefers to offer more direction in the form of a navigable interface that relates to the structure of the subject. Both views have their merits, but for an open learning system such as the Internet a structured interface appears to be more appropriate.

The most widely used information structure is that of object oriented hierarchy, this model is popular because it appears to reflect the way people assimilate and process information. Books have such structures with object forming a hierarchy of chapter, section and smaller components and a user interface in the form of a content page. More appropriately, computer filing system and user interface such as that of Microsoft windows have object-oriented structures. From the point of view of constructivist theory the wide use of concept maps and schemes supports the view that personal knowledge is either object oriented or can be related to information having such a structure.

Object oriented model have been developed for a number of course. These are delivered on an internal network and the Internet. The structure adopted for the course on information technology is illustrated in figure given below. This is derived from a simple list representing the content of a book. It can be regarded as concept map that might be drawn by the course designing in which the objects correspond to the nodes and the link describe the relationships between them. It is descried how as a study map. It represents the same view of the subject area as the book treatment but the some additional fitness in the form of navigational information indicating the sequence in which the objects may be studied. This is necessary to complete the hierarchical logic. Other peripheral objects can be added to show the entire course linked to entire knowledge.



In developing the hierarchy, it is inferred that an object at one level should be logical component of another at the level immediately above. This principle of composition is easily satisfied at the higher levels but break down at the lower ones. However, it generates a paradoxical relationship in which one object is seen as a component of another, which is a component of a first one. Each object is recognized as a complete treatment of its associated topic rather than a component of a more abstract one. The links between the adjacent objects describe a more subtle relationship than simple composition. In object oriented theory they can be related to a hierarchical model based on composition and another property known as inheritance.

Conclusion

In the present context, it is sufficient to accept the empirical conclusion that the objects are complete treatments of the topics and the links define two-way relationship between adjacent topics in which each can be viewed as a component of other. The result may be descried as constructivist information system. Any object can be expanded in this way. This is firmly in line with the constructivist principle and it is a format that is readily available on the Internet.

The constructivist revolution offers a new vision of the learner as an active sense-maker and suggests new methods of instruction. It facilitates presentation of materials in a constructivist way and engage students in an active explorative learning. This new approach allows the learners to have more control over their own learning to think analytically and critically, and to work collaboratively. This constructivist approach is an effort at educational reform made easier by technology. In this process the learner has access to global rather than local software and maintain a direct link to the teacher. This interactivity may take the form of a direct e-mail link, electronic conferencing or an automated connection to a server programme. This is a revolutionary vision of education.

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CONSTRUCTIVIST PEDAGOGY IN THE CLASSROOM: A PARADIGM SHIFT

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The latest catchword in educational circle is "constructivism, "applied both to learning theory and to epistemology – both to how people learn and to the nature of knowledge. The term refers to the idea that individuals, through their interaction with the environment, construct their own knowledge and meaning (Fosnot 1996; Steffe and Gale, 1995). This metaphor of construction comes from the idea that humans are builders, shapers, and designers, who throughout history have created artifacts from pots to skyscrapers. All these tangible products were and are still being built through the process of selecting the materials, arranging or mixing the materials together, resulting in a whole that is greater than some of its parts (Spivey, 1997). However, as humans we also create mental products or meanings as well as creating things. These meanings can be referenced as understandings, interpretations, responses, intentions, plans, or memories. Mayer (1996) refers to this idea as the SOI model to highlight three crucial cognitive processes in constructivist learning: S for selecting relevant information, O for organizing incoming information, and I for integrating incoming information.

The emphasis of the constructivist theory is on the process, rather than the product of learning. A constructivist approach would have the student determine how much they have learned as well as the process by which they have come to know. Such a theory of knowledge and learning has significant implication for teaching. It changes the dynamics of the traditional classroom by empowering the learner as the focus and architect of the learning process while redefining the role of the instructor to be a guide and helper, rather than the source and conduit of knowledge. Constructivism has become an educational theory of choice for many within modern educational institutions. Gaining insight into its core pedagogical principles and how these principles determine/influence the major aspects of classroom instruction, e.g. role of the teacher, instructional strategy, evaluation, is important on the part of the teachers and the teacher-educators who really want to participate in this movement.

Four Major Assumptions of Constructivist Learning Theory

The constructivist learning theory is based on the following four major assumptions

- Knowledge depends on past constructions. We know the world through our mental framework and we transform and interpret new information through this framework.
- Constructions come through systems of assimilation and accommodation into our existing mental framework.
- Learning is an organic process of invention, not mechanical.

- Meaningful learning occurs through reflection and scaffolding of new knowledge upon existing framework of knowledge.

Characteristic of constructivist learning

- Goals and objectives are derived either by the learner or in negation with the teacher or system
- Teacher plays the role of facilitator, guide monitor and coach
- Learner plays a central role in mediating and controlling learning
- Knowledge construction and not reproduction is emphasized
- Knowledge construction takes place in individual contexts and through social negotiation, collaboration and experiences
- Learners' previous knowledge, beliefs and attitudes are considered in the knowledge construction process
- Learning environments are created where activities, opportunities, tools are provided to encourage meta-cognition, self-analysis, self-regulation, self-reflection and self-awareness
- Content, skills, tasks and learning situation are relevant, realistic, authentic and represent the natural complexities of the 'real world'
- Primary sources of data are used to ensure authenticity and real-world complexity
- Problem-solving, critical and creative thinking skills and deep understanding are emphasized
- Wrong answers provide the opportunity for insight into students previous knowledge construction
- Learners are encouraged to explore the new knowledge independently and to manage the pursuit of their goal
- Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills, and knowledge construction
- Conceptual interrelatedness and interdisciplinary learning are emphasized which reflex knowledge complexity
- Collaborative and cooperative learning are focused in order to expose the learner to alternative viewpoints and encourage social interaction
- Scaffolding facilitate to enable students perform just beyond the limits of their ability
- Assessment is interwoven with teaching

Constructivist Pedagogy

Instruction that is based on constructivist principles is extremely demanding of the teacher. The three domains of teacher knowledge that are important to their effectiveness in moving to constructivist approaches include, general pedagogical knowledge, subject-matter knowledge, and pedagogical content knowledge. Constructivist pedagogy is the link between theory and practice. Many theorists and practitioner (Brooks and Brooks, 1993; Driscol, 1994; Jonassen, 1991) have generated constructivist pedagogies with an array of results. While these pedagogies share a set of core design principles, the peripheral principles tend to vary greatly. The general theoretical and practical constructivist consensus across all the three types of constructivism, viz. cognitive constructivism, social constructivism, and radical constructivism, indicates that eight factors are essential in constructivist pedagogy (Brooks and Brooks, 1993; Larochelle, Bednarz and Garrison, 1998; Steffe & Gale, 1995). These principles, however, are not solely constructivist in nature. Indeed, all these principles have been proposed by other theories/theorists in other times. What makes these principles "constructivist" is the assemblage and the rationale for their inclusion.

(i) Learning should take place in authentic and real-world environments

Experience, both socially oriented and object oriented, is a primary catalyst of knowledge construction. Experience provides the activity upon which the mind operates. In addition, knowledge construction is enhanced when the experience is authentic.

(ii) Learning should involve social negotiation and mediation

While only social constructivism emphasizes social interaction as a basis for knowledge construction, cognitive and radical constructivism do assign social interaction a role. Social interaction provides for the development of socially relevant skills and knowledge. In some cases, e.g. greetings, gender relations, dress, knowledge can only be attained through social contact. As an individual gains experience in a social situation, this experience may verify his knowledge structure or it may contradict those structures. If there is contradiction or confusion, then the individual must accommodate this contradiction in order to maintain an accurate or social model of reality. Language is the medium through which knowledge and understanding are constructed in social situations (Spivey, 1997).

(iii) Content and Skills should be made relevant to the learner

Constructivism emphasizes the concept that knowledge serves an adaptive function. The knowledge attained, i.e. content and skills, in order to enhance one's adaptation and functioning, must be relevant to the individuals need, understanding, and goal. This relevancy is likely to increase the individuals' motivation. Ultimately, experience with relevant tasks will provide the individual with the mental process and social experiences necessary for enhanced functioning within one's practical environment.

(iv) Content and skills should understand within framework of the learner's prior knowledge

All learning begins with an individual's prior knowledge, regardless of constructivist affiliation. Understanding a student's behaviour requires an understanding of the student's mental structure, i.e. an understanding of the student's understanding. When a student replies that the answer to 54 – 38 is 24, the teacher must not think it immediately to be wrong, but rather try to understand the student's understanding of subtraction that has led to this answer. In this case, the student appears to be using the following rule of subtraction: "Subtract the smallest from the largest". Understanding the student's rule usage makes it much easier for the teacher to demonstrate the non-viability of the student's understanding. The teacher in this case, for example, may ask the student to count out 54 blocks, then take away 38 blocks from that pile, and finally count the remaining 16. Only by attempting to understand a student's prior knowledge will the teacher be able to create effective experiences, resulting in maximal learning.

(v) Students should be assessed formatively, serving to inform future learning experiences.

Constructivism asserts that the acquisition of knowledge and understanding is an ongoing process that is heavily influenced by a student's prior knowledge. Knowledge and understanding are not directly visible, but can be inferred from one's action. Thus, to take into account an individual's current level of understanding in this ongoing teaching-learning process, a teacher must continually assess the individual's knowledge. This formative assessment is necessary to create the subsequent series of experiences and activities for the students.

(vi) Students should be encouraged to become self-regulatory, self-mediated, and self-aware

The underlying tenet of constructivism is that learners are active in their construction of knowledge and meaning. This activity involves mental manipulation and self-organization of experiences; and requires that students regulate their own cognitive functions, mediate new meaning from existing knowledge, and form an awareness of current knowledge structures. Within a cognitive constructivist perspective, self regulation, self-mediation, and self-awareness would be subsumed under the construct of metacognition. Metacognition is considered an essential aspect of learning and consists of (i) knowledge of cognition, and (ii) regulation of cognition (Brown & Palincsar, 1987). Vygotsky (1978) believed that students construct mental signs or psychological tools to represent concepts and relationships, and that these tools are used to mediate cognition. Similarly, Piaget (1977) theorized that students mentally reflect on the use and nature of objects and then construct new knowledge by generalizing new relationships.

(vii) Teachers serve primarily as guides and facilitators of learning, not instructors

The role of the teacher, in constructivist perspective, is to motivate, provide examples, discuss, facilitate, support, and challenge, but not to transmit knowledge. In the cognitive constructivist perspective, the role of the teacher is to create experiences in which the students will participate that will lead to processing and acquisition of knowledge. On the other hand, social and radical constructivism argue that the only role of the teacher is to guide students to an awareness of their experiences and socially agreed-upon meanings. They advocate that there is no factual knowledge to transmit.

(viii) Teachers should provide for and encourage multiple perspectives and representations of content

The relationship of multiple perspectives and multiple representations is one of cause and effect. Experiencing multiple perspectives of a particular event provides the student with the raw materials necessary to develop multiple representations. These multiple representations provide students with the ability to develop more complex schemas relevant to the experience. In a nut-shell, multiple perspectives provide the students with a greater opportunity to develop a more viable model of their experiences and social interactions.

Constructing Knowledge in the Classroom

In the classroom our students represent a rich array of different backgrounds and ways of thinking. Myths, taboos, and things we learn from our families, friends, and teachers, all are part of cultural influence. Content is embedded in culture and it is difficult to separate the two. When presented with information in the classroom that contradicts existing ideas, a student may try to accommodate both interpretations, rather than change deeply held beliefs. Unless the teacher realizes what views the students hold, classroom teaching can lead students to construct faulty ideas. If the classroom can provide a neutral zone where students exchange their personal views and test them against the ideas of others, each students can continue to build understanding based on empirical evidence. Hands-on activities and observations of the natural world provide shared experiences for those construction. For example, to study the phases of the moon, the class could keep a 'sky journal', i.e. an observational log of the moon and its shape in the sky, for several weeks. Small groups discuss the various observations and speculate about their meanings. If models, text references, or illustration are available as resources, students should know that these are the results of others observations and speculations. Such references are actually the 'construction' by others of the current understanding of the world around us.
Research on instructional advancement of the last 30 years, particularly in the areas of cognitive processing, teacher effects, and teaching of cognitive strategies, revealed that the constructivist view affects all the important aspects of the teaching-learning process, e.g. role of the teacher, classroom environment, instructional strategy, evaluation (Rosenshine, 1996). The major aspects that mostly influence knowledge construction in the classroom are discussed in more details as follows:

The Constructivist Classroom

A constructivist classroom must obviously operate in the backdrop of constructivist learning environments and the key principles of constructivism. In the constructivist classroom, the focus tends to shift from the teacher to the students. The classroom is no longer a place where the teacher pours knowledge into passive students, who wait like empty vessels to be filled. Students are actively involved in the learning process and given the opportunity to construct knowledge based on their own background. The constructivist teacher sets up problems and monitors student exploration, guides the direction of student inquiry, and promotes new patterns of thinking. Classes can take unexpected turns as students are given the autonomy to direct their own explorations. In specific terms, a constructivist classroom bears the following characteristics (Brooks & Brooks, 1993) :

Students' autonomy and initiative are accepted and encouraged
By respecting students' ideas and encouraging independent thinking, teachers help students attain their own intellectual identify. Students who frame questions and issues and then go about analyzing and answering them, take responsibility for their own learning and become problem solvers.

The teacher asks open-ended questions and allows wait time for responses.
Reflective thought takes time and is often built on others' ideas and comments. The ways teachers ask questions and the ways students respond will structure the success of student inquiry.

Higher-level thinking is encouraged.
The constructivist teacher challenges students to reach beyond the simple factual response. He encourages students to connect and summarize concepts by analyzing, predicting, justifying, and defending their ideas.

Students are engaged in dialogue with the teacher and with each other.
Social discourse helps students changes or reinforce their ideas. If they have the chance to present what they think and hear others' ideas, students can build a personal knowledge base that they understand. Only when they feel comfortable enough to express their ideas will meaningful classroom dialogue occur.

Students are engaged in experiences that challenge hypotheses and encourage discussion.
When allowed to make prediction, students often generate varying hypotheses about natural phenomena. The constructivist teacher provides ample opportunities for students to test their hypotheses, especially through group discussion of concrete experiences.

The class uses raw data, primary sources, manipulatives, physical, and interactive materials.
The constructivist approach involves students in real-world possibilities, then helps them generate the abstractions that bind phenomena together.

The Constructivist Teacher

Constructivism, as a theory of learning, is based on the idea that learning occurs when a learner actively constructs a knowledge representation in working memory. According to this view, the learner is a sense maker, whereas the teacher is a cognitive guide. In the classroom, the constructivist view of learning can point towards a number of different teaching practices. In the most general sense, it usually means encouraging students to use active techniques, e.g. experiments problem solving, to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure she understands the students' preexisting conceptions, and guides the activity to address them and then build on them.

Constructivist teachers encourage students to constantly assess how the activity is helping them gain understanding. By questioning themselves and their strategies, students, in the constructivist classroom, become expert learners. When they continually reflect on their experiences, they develop increasingly strong abilities to integrate new information. One of the main roles of the teacher here is to encourage this learning and reflection process. For example : Groups of students in a science class are discussing a problem in physics. Though the teacher knows the answer to the problem, she focuses on helping students restate their questions in useful ways. She prompts each student to reflect on and examine his or her current knowledge. When one of the students comes up with the relevant concept, the teacher seizes upon it, and indicates to the group that this might be a fruitful avenue for them to explore. They design and perform relevant experiments. Afterward, the students and teacher talk about what they have learned, and how their observations and experiments helped or did not help them to better understand the concept.

Contrary to criticisms by some traditional educators, constructivism does not dismiss the active role of the teacher or the value of expert knowledge. Constructivism modifies that role, so that teachers help students to construct knowledge rather than to reproduce a series of facts. The constructivist teacher provides tools such as problem-solving and inquiry-based learning activities with which students formulate and test their ideas, draws conclusions and inferences, and pool their knowledge in a collaborative learning environment. Constructivism transforms the student from a passive recipient of information to an active participant in the learning process. Always guided by the teacher, students construct their knowledge actively rather than just mechanically receiving knowledge from the teacher or the textbook.

In the nut-shell, the constructivist teachers perform the following roles:

- Encourage and accept student autonomy and initiative.
- Use raw data and primary sources, along with manipulative and interactive materials.
- Use cognitive terminology such as 'classify' 'analyze', 'predict', and 'create'.
- Allow student responses to drive lessons, shift instructional strategies, and alter content.
- Inquire about students' understanding of concepts before sharing their own understanding of those concepts.
- Encourage students to engage in dialogue, both with the teacher and with one another.
- Encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other.
- Seek elaboration of students' initial responses.

- Engage students in experiences that might endanger contradictions to their initial hypotheses and then encourage discussion.
- Allow wait time after posing questions.
- Provide time for students to construct relationships and create metaphors.
- Nurture students' natural curiosity through frequent use of the learning cycle model.

Instructional Strategies

The constructivist revolution offers a new vision of the learner as an active sense maker and suggests new methods of instruction. It facilitates presentations of materials in a constructive way and engage students in an active explorative learning. The new approach allows the learners to have more control over their own learning to think analytically and critically, and to work collaboratively. This constructivist approach is an effort at educational reform, and particularly a revolutionary vision of instructional strategies. Research on instructional strategies, particularly in the areas of cognitive processing, teacher effects, and teaching of cognitive strategies, suggest specific instructional principles that can be of great use to create constructive learning environment in the classroom. The important and workable ones are as follows (Rosenshine, 1996, pp.1019) :

- Present new materials in small steps (Rosenshine and Stevens, 1986).
- Help students develop an organization for the new material (Palincsar & Brown, 1984).
- Guide student practice (Hunter, 1982)
- When teaching higher level tasks, support students by providing them with cognitive strategies (Pressely et al., 1995).
- Help students learn to use the cognitive strategies by providing them with procedural prompts and modeling the use of these procedural prompts (Palincsar and Brown, 1984; Scardamalia and Bereiter, 1985).
- Provide for extensive student practice
- Provide models of the appropriate responses: (i) during initial instruction, before students practiced; (ii) during practice; and (iii) after practice.
- Anticipate and discuss potential difficulties.
- Regulate the difficulty of the material.
- Provide feedback and corrections.
- Increase student responsibilities.
- Provide independent practice with examples.

Evaluation

In traditional teaching-learning process, evaluation presupposes a universal goal for the instruction. An evaluation programme intends to measure the progress towards the goal, and the information compiled about many students suggests the relative proficiency of the system in terms of achievement of the goal. With a constructivist view of knowledge, the goal is to improve the ability to use the content domain in authentic tasks (Brown, Collins and Duguid, 1989). The evaluation must examine the thinking process. This is not to suggest, however, that the issue of thinking is independent of the content domain (Bendar et al, 1995). Possible ways of evaluation would, for example, be asking students to think aloud, address a problem in the filed of content and then defend their decision, or reflect on their own learning and document the process through which they have constructed their view of the content. In a nut-shell, evaluation of student learning, from a constructivist perspective should not be judged only on the specifics of knowledge, but whether the student can solve the problem posed with viable solution (Sharma, 2001).

In a constructivist learning environment technology plays an acknowledged and purposeful role in the day-to-day activities, but does not become the object of instruction (McClintock, 1992). According to its advocates, this environment can provide students with a complex laboratory in which they can observe, question, practice, and validate knowledge. The following model is presented below to give a clear picture of constructivist learning situation.

Interpretation Construction (ICON) Design Model

Interpretation Construction Design Model may be used to create constructivist learning situation in the classroom. The steps of the ICON Model are resented below.

- **Observation:** Students make observations of authentic artifacts anchored in authentic situations
- **Contextualization:** Students access background and contextual materials of various sorts to aid interpretation and argumentation
- **Cognitive Apprenticeship:** Students serve as apprentices to teachers to master observation, interpretation and contextualization
- **Collaboration:** Students collaborate in observation, interpretation and contextualization
- **Interpretation Construction:** Students construct interpretations of observations and construct arguments for the validity of their interpretations
- **Multiple Interpretations:** Students gain cognitive flexibility by being exposed to multiple interpretations
- **Multiple Manifestations:** Students gain transferability by seeing multiple manifestations of the same interpretations (Black and McClintock,1995)

Learning situation-1

- Students study astronomy and science in general by using observations of telescopic plates and a computer simulation of the sky to construct and test interpretations of astronomical phenomena. Students examine and make measurements on photographic plates from observatory telescopes and computer simulations of the sky **(Observation)**, then relate these analyses to reference materials **(Contextualization)** containing what is know about astronomical objects (i.e., stars, planets, etc.).

- The teacher initially talks through how he would analyze and interpret examples of such astronomical data **(Cognitive Apprenticeship)** then the students form groups to work on some data **(Collaboration)**, while the teacher coaches and advises them as they proceed.
- The students develop their own hypotheses and test them against the astronomical data **(Interpretation Construction).** Students defend their hypotheses using their analyses and reference materials both within and between the groups, and such argumentation together with background readings exposes them to various ways to interpret the data **(Multiple Interpretations).**
- As they proceed through the course, the students see how basic principles of astronomy, physics and chemistry can be used to make sense of different sets of astronomical data **(Multiple Manifestations).** (Black and McClintock,1995)

Learning Situation-2

- Learners read a text on mammals and view a video on the life of mammals in different locales. Such events or activities consist of mammals moving in groups on land or in water, grazing, attacking a prey, giving birth, flocking together at the time of danger and related events.
- Learners make note of the key events or behaviour or activities of mammals.
- They relate their analysis to the text.
- Teacher illustrates how he/she would analyse and interpret such information using the example of mammals.
- Learners form groups to work on the task while the teacher suggests/guides them as they proceed.
- Learners analyse and generate evidence to verify their hypothesis related to mammals living on land or water, etc.
- They provide explanations and defend their ideas or hypotheses using their analyses and text both within and between groups.
- Evidence and arguments along with the text expose them to various ways of finding answers or interpreting data.
- By going back and forth through the process and relating each contextual background on various events and the behaviour of mammals, the learners notice that the general principles embedded in what they are doing become manifested.(NCF 2005)

Learning Situation-3

- Presents the students with a graphic simulation of an archaeological site, then the students study the history of the site through simulated digging up of artifacts, making various measurements of the artifacts in a simulated laboratory **(Observation)**, and relating the objects to what is already known using a wide variety of reference materials **(Contextualization).**
- The students work cooperatively in groups **(Collaboration)**, while the teacher models how to deal with such a site then fades her involvement while coaching

and supporting the students in their own study efforts (**Cognitive Apprenticeship**).

- The students develop ownership of their work by developing their own interpretations of the history of the site and mustering various kinds of evidence for their conclusions (**Interpretation Construction**). By arguing with the other students and studying related interpretations in the historical literature, they get a sense of other perspectives (**Multiple Interpretations**).
- The students develop ownership of their work by developing their own interpretations of the history of the site and mustering various kinds of evidence for their conclusions (**Interpretation Construction**). By arguing with the other students and studying related interpretations in the historical literature, they get a sense of other perspectives (**Multiple Interpretations**).
- By going through the process a number of times bringing each contextual background to bear on a number of different artifacts, the students learn and understand the many ways that the general principles behind what they are doing become manifest (**Multiple Manifestations**). (Black and McClintock,1995)

Learning Situation-4

- Students study Shakespearean drama and English literature English literature in general by using the text of the play and two or more videos of performances of the play. Students can read a portion of Macbeth (e.g., a scene) and then immediately jump to see one or two performances of what they have read (**Observation**).
- The students can also use this indexing system to jump to commentaries on the same portion of the play (**Contextualization**). Using portions of the play, the teacher models how to integrate reading the play, watching the performance and reading the commentaries (**Cognitive Apprenticeship**) and the students work together in groups (**Collaboration**) to develop their own interpretations of the play and how it should be performed (**Interpretation Construction**).
- Comparing their interpretations of the play with the other students both within the same group and then in different groups gives the students a sense of the many different reactions that people can have to a play like Macbeth (**Multiple Interpretations**).
- The multimedia indexing system also facilitates the students jumping around in the text and videos to see how the same entities (e.g., characters, themes, etc.) can be manifested in many different ways in the text and performances (**Multiple Manifestations**). (Black and McClintock,1995)

Learning situation-5

- Learners read the story 'Kabuliwallah'. Later, they are given background material with illustrations of certain scenes of the story and brief descriptions. A few learners enact one or two scenes depicted in the illustrations.
- Learners watch the scenes enacted.
- They relate the story of the text with the illustrations of the background material.

- Using a scene enacted, the teacher models how to integrate reading the story and the illustrations of the background material.
- Learners work in groups to generate interpretations while the teacher suggests/guides them as they proceed.
- They analyse and generate their own interpretations of the story.
- Comparing the interpretations within and between groups gives the learners the idea that people can have different reactions to the story, 'Kabuliwallah'.
- Using the text, background illustrations and their own reflections, the learners see how the same characters and themes can be manifested in several ways. (NCF 2005)

Conclusion

The constructivist view of the world as having reality only as it is understood by the learner signals a dramatic departure from theories which view the world as objective truth to be explained and accepted. This change represents a fundamental shift in the understanding of the learning relationship. It gives new status to the learner as the active constructor within the learning activity instead of being the passive respondent to externally determined world of education. Constructivism challenges learners to move beyond fact learning to more transportable cognitive understanding. It defines teaching to be an exciting process of joining in the intellectual discovery of others. The constructivist teacher becomes a partner who is given the opportunity to see familiar educational vistas through new eyes and in a real sense becomes a fellow learner with the students he serves. Becoming a constructivist teacher may prove a difficult transformation since most instructors are prepared for teaching in the traditional manner. It is seen that most of our teachers seek to transmit vast amount of information, within a limited time, using textbooks, and multimedia. This is how human brain is misutilized in our schools. The use of cheap electronic devices, like computes for storing vast amount of information can substantially reduce the burden of human brain. Now human brain which posses the ability to think can profitably be used to perform those tasks that cannot be done by a machine, e.g. decision making, creative thinking, problem solving. It requires a paradigm shift and the willing abandonment of familiar perspectives and practice; and the adoption of new ones (Brooks and Brooks, 1993, p.25). We are convinced that the pedagogy of future will develop increasing effective procedures based on constructivist principles. The internet makes it possible to develop two radically new notions in education: communities of learners and communities of users. In each case, learners can discover and develop an identity that situates them with regard to the subject matter. Whatever the subject to be learned, the notion of pedagogic space now needs to be rethought. Pedagogy can both become a truly productive activity and escape the pattern of blaming individual failure on either bad teachers or bad students.

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EXEMPLAR IN ENGLISH GRAMMAR

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Subject : English (grammar)
Class : IX
Duration: 60 minutes
Topic : Simple Present Tense

A. Process Based Objectives :

The student will be able to:

- Acquire language skills.
- Develop ability to work in group successfully.
- Develop ability to use the media and technology in his/her study.

B. Content Based Objectives:

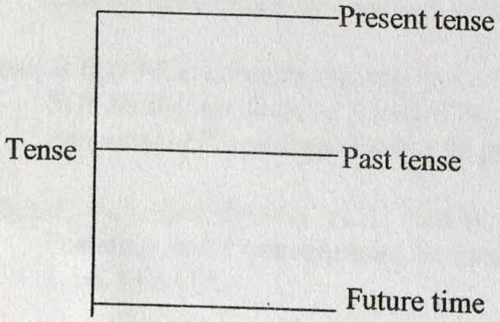
The student will be able to –

- To explore the underlying principles in the use of simple present use.
- Correct the error in the given sentences following the principles.
- Describe their regular habits in sentences using simple present tense.
- Identify the simple present tense form of verb in the sentences.

I. Observation

Learning Situation:

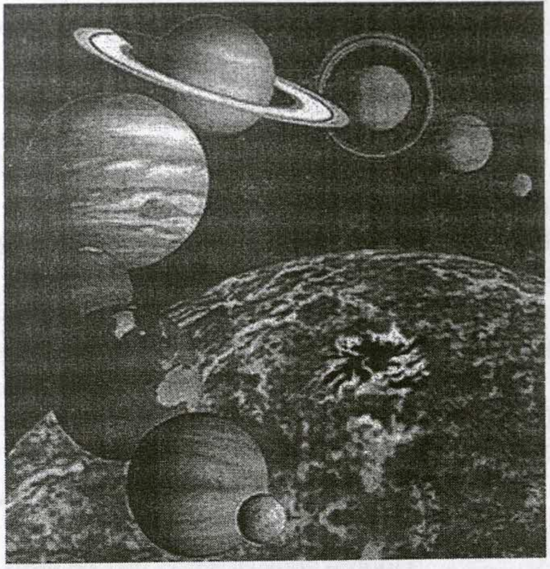
The teacher will give a power point presentation on simple present tense.



Principles of Simple Present Tense:

(1) **Universal Truth**

- A picture of solar system will be shown to the students.
- 2 and 2 makes 4.



(2) **Habitual Truth**

- You get up every day at 5 o'clock.
- The school begins at 10.00am.

(3) **'Here' and 'There' at the beginning**

- Here he comes.
- Here comes the bus.
- There she goes.
- He is coming here to write on the blackboard.
- The boy is coming here to take rest.
- There goes the charm of the party.
- People are not going there because they think there is a ghost.

(4) **Quotations**

- Shakespeare says, "Uneasy lies the head that wears a crown."
- Keats says, "A thing of Beauty is a joy for ever."
- Thomas Dekker says, "Age is like love, you cannot hide it."

- Subhas Bose says, "Give me blood I will give you freedom."

(5) Sports Commentaries

Recordings of a live cricket or football match can be played before the students. Students will be asked to listen to the recordings.

- The player scores a goal.
- He carries the ball to the bowler.
- The batsman hits sixes.

(6) Permanent fact/situation

- The school faces towards east. (a picture of school building facing towards east can be shown)
- Cuttack stands at the bank of the Mahanadi.
- The Mahanadi falls into Bay of Bengal. (a map showing coast of Orissa and Bay of Bengal can be shown)

(7) Verbs of Perception (see, hear, feel, smell, taste)

- I see clouds in the sky during rainy season.
- He hears the sound of orchestra party.
- We feel cold in winter.
- Sugar tastes sweet.
- Rose smells nice.

II. Contextualization

The students will relate the background material with the context and the in formations given by the teacher. The teacher will give the following description about the context.

- *Time is understood in terms of the past, present and the future.*
- *Tense forms on the other hand refer to a certain type of classification of verb forms in a language.*
- *Time is a non-grammatical whereas Tense is a grammatical concept.*

For Example:-

	Tense		
Verb	*Present*	*Past*	*Past participle*
Go	go	went	gone
Come	come	came	come

- *To express happenings or events relating to past time,, past form or past participle form of the verb is used.*
- *Whereas to express present time we use present form of the verb.*

Let's explore the situation where we can use simple present tense.

III. Cognitive Apprenticeship

The teacher will model how to integrate reading the given context, watching the pictures and interpretation. Under the direct observation of the teacher, the students proceed through observation, contextualization, and collaboration. The teacher will give comprehension questions in power point presentation to ensure the progress of the students.

For first use

- Give some statements; which are universally true.
- What is the verb form used in the given statements.
- In which tense form the statements are written.
- In which situation would you conclude from the above, (reference material) simple present is used.
- Draw your conclusion that simple present tense is used.

For second use

- How do you come to your school?
- Do you come to your school by bus always?
- Do you get up early in the morning?
- When do you get up in the morning?
-

Answer will be given by the students:

- From your answers state the verb form and the tense form of the sentences.
- What are the time adjuncts of verb used in the sentences?
- In which cases would you conclude that simple present is used?

For third use

- (referring the learning situations) Classify the sentences which are in simple present tense.
- Classify the sentences which are not in simple present tense.
- What is the position of here and there in the sentences classified under simple present and what is the position of here and there in sentences in other tense forms.
- From above sentences please infer the principle in which simple present tense can be used.

For fourth use

- Write some quotations with their speaker's name.
- Identify the tense form of underlined verbs (referring learning situation)
- Under which tense form the reported verbs (underlined words) come.
- From the above observation which principle would you deduce with regard to the use of simple present tense?

For fifth use

- Students will be asked to listen to the recordings carefully and to mark the tense form used by the commentator.
- Questions will be asked to the students:-

1- What did you listen to?
2- In which tense form the commentator described the happenings of a cricket match/which tense form the commentator used to describe the match.
3- From above context explore the principle in which simple present tense is used.

For sixth use

- (referring learning situation) To which direction the school faces?
- Does the school face towards east permanently?
- Which town permanently stands at the bank of river Mahanadi?
- Does the town permanently stand at the bank of river Mahanadi?

From the above observation infer the principle of the simple present tense form which has been used here.

For seventh use

- Questions will be given using verbs of perception.
    1. How does sugar taste?
    2. What do you see in the sky during rainy season?
    3. Which sounds do you hear in an orchestra party?
    4. How do you feel in winter?
    5. What do you do with your nose?
- Answers will be given by the students. In answers they will be told to underline the verb.
- From the above answers draw conclusion in which tense form the verbs will remain?
- Explain why your answers belong to simple present tense.
- Explore the principle of simple present tense use here.
- Explore the relation between verbs and sense organs.

IV. Collaboration

The teacher will form 4 to 5 heterogeneous groups consisting of 5 to 6 students in each group, in the classroom. The students will have to work in groups to interpret the grammatical principles for simple present tense. Each and every member of each group will help to answer the questions put by the teacher in step-III. They will draw the conclusion at the end of discussion.

V. Interpretation Construction/Multiple Interpretations

The students will be allowed to interpret the context by their own. They will note down their interpretations, new ideas in their note books. They will discuss among themselves and arrive at a common conclusion. There will be multiple interpretations on certain points. But their common conclusion will be accepted by the teacher.

VI. Multiple Manifestations

The interpretations of the students will be manifested in multiple ways. The teacher will provide certain tasks for multiple manifestations. It may be given in power point presentation.

1. Match A an B and write out factually correct sentences. Link them with an appropriate verb in the simple present tense. Remember the verb must agree with the subject.

A	B
The Mahanadi	Underground
Water	Lead(pb)
Most paints	At 100 degree C at STP
Alligators	One million
The planets	In swamps
Mega	Bay of Bengal
Bronze	Round the sun
potatoes	copper

2. Choose one member of your group and write a description of him or her using the following guidelines.

- physical features
- habits, likes and dislikes
- personality

3. Correct the sentences (if any).

- He knows his faults.
- The English is dwelling in England.

- Atmosphere contains gases.
- A religious man is not taking wine.
- He is speaking truth and I am telling lies.
- The sun gives light to the moon.

Websites

- www.web2.uvcs.uvic.ca/elc/studyzone/330/grammar/plan.htm-7k
- www.web2.uvcs.uvic.ca/elc/studyzone/330/grammar/presn9.htm.-9k
- www.englishpage.com/verbpage/simplepresent.html-13k
- www.englishclub.com/grammar/verb.tense-present.htm.-9k
- www.englishclub.com/grammar/verb-tense-present-quiz.htm-6k
- www.4esl.org/9/h/ib/psv.htm-5k
- www.eslgold.com/grammar/simple-present.htm-28k
- www.learnenglish.de/Grammar/tensesimple.htm-19k
- www.youtube.com/watch?v=ywccP9g/Db1
- www.easypresenttense.com/-12k
- www.wikipedia.org/wiki/present-tense-42k

EXEMPLAR IN ENGLISH LITERATURE

Dr.Harihar Sarangi
Reader in Education
P.G.Dept. of eucation
G.M.College, Sambalpur

Class : IX
Subject : English
Time : 45 minutes
Topic : "The Road Not Taken"
(A poem written by Robert Frost)

Pedagogy/Process Based Objectives

The students will able to develop:

- Reflective thinking
- Imagination
- Creativity
- Hypothetical thinking
- Ability to predict, judge and explain
- Appreciate poetic diction
- Ability for multiple interpretation of words, phrases and ideas
- Construct new ideas in the poem on their own
- Appreciate the use of metaphors, similes, imagery etc.
- Explore pattern of rhyme and its interpretation
- Ability to work successfully in teams
- Ability to find out many sources of information
- Ability to evaluate, summaries and communicate information clearly
- Ability to use media and technology critically.

Content Based Objectives

Students, at the end of this lesson, will able to-

- Specify some of the choices they make could be represented by the 'two roads'. For example, college, career, spouses, exclusive ideas, values, beliefs etc.

- Make multiple interpretation of words, phrases and lines used in the poems, such as 'a yellow wood', 'sorry I couldn't travel both, 'as just as fair', 'grassy and wanted wear', 'less travelled by', 'that has made all the difference', etc.

- Evaluate and predict the feeling of the poet and his personality traits from the title 'The Road Not Taken', 'I took the one less traveled by', 'I doubted if I should ever come back', 'I shall be feeling this with a sigh' etc.
- Identify the rhyme scheme of the poem and explore its implications in evaluating poet's life pattern. For example, the rhyme scheme in the beginning, perhaps suggests that the poet makes efforts to save his life into a pleasing and coherent form and a slight shift in lines 19-20 that 'difference' does not rhyme precisely with 'hence' might suggest that the speaker is trying just a little hard to pattern his life.

I. Observation

Situation 1
***Teacher*:** To go to your school, there are two roads. Most of the students go to school on first road, but a few students go to school on second road. Tell, on which road will you go and why?

Situation 2
Teacher: Show a video picture of a yellow wood where two roads diverged. Out of two roads one is grassier and less travelled by as compared to other. Teacher will tell well students, supposing that you are moving in a jungle and in one point you saw two roads diverged as shown in the picture. Tell, on which road will you travel and why?

(Add picture of a yellow wood)

Situation 3
Teacher: Supposing that you have been selected for studying engineering and medical science. Which course will you choose and why?

After discussing above questions with the students, the teacher will say well students; to know more we shall learn a poem i.e. 'The Road Not Taken' written by Robert Frost. Let us know about Robert Frost in brief.

Power Point Presentation

Robert Frost (1874-1963)

An American Poet
Born at San Francisco

Went to England in 1912 and Published A Boy's Will (1913) and North of Boston (1914)

Returned to America after publication of the second book.

Publications

Mountain Interval (1916)
West Running Brook (1928)
A Further Range (1936)
A Masque of Reason (1945)
A Masque of Mercy (1947)
Complete Poem (1949)
In the Clearing (1962)

Listen to the Poem :The students will listen to a recording of the poem.

Read the Poem Silently : The students will be directed to read the poem silently.

Exploring the Meaning of the Difficult Words

To facilitate students' understanding, the teacher will present the meaning of the difficult words as are given exactly in the Dictionary through Power Point. Students will be asked to explore the appropriate meanings. If every one is supplied with a Computer, he/she may be asked to explore the meaning from the Computer.

Power Point Presentation

Dictionary Meaning

Diverge: I. (*v.i*) (of lines, paths, opinions etc.) gets further apart from a point or from each other as they progress, II Turn or bend away from.

Sigh: I *(v)* when you sigh, you let out a deep breath, as a way of expressing feelings such as disappointment, tiredness or pleasure. II. If a wind sighs through a place, it moves through the place with a sound like sigh.

Tread: I. *(v.i)* if you tread on something, you put your foot on it when you are walking or standing. II if you tread in a particular way, you walk that way III. *(n)* a person's tread is the sound that he makes with his feet as he walks. iv. if you tread carefully you behave carefully or with caution v. *(n)* the tread of a step or stair is its flat upper surface.

Trodden: trodden is the past participle of tread.

Undergrowth: (*n*) (*u*) shrubs, bushes, low trees growing among taller trees.

Wear: I. (*v.t)* to use, to bear or have in one's aspect or appearance, to carry out body, to arrange (cloths, hair) in a specified way. II *(n) (c)* another *spelling of weir*, a dam across a river, and fens of stakes set in a stream for catching fish, wall or barrier across a river to control the flow of water.

Yellow Wood: i. the hard, yellow wood of a fabaceous tree of the Southern U.S.A. II. The tree itself having showy, white flower and yielding a yellow dye III. any of the various other yellow woods, as that of a small tree of South Florida and neighbouring regions IV. Any of the tree yielding these woods.

Teacher's Role: Teacher acts as a facilitator by asking meaning of these words that best suit the context of the poem explored by the students. They are also asked to justify their answers by describing authentic situation anchored in the poem.

II. Contextualization

The teacher will give the following illustrations about the background of the poem so that the students will relate the context of the poem with the illustrations.
This is a poem about walking in the wood and choosing one of the two paths to follow. The speaker prefers the less traveled path to walk. The poem invites us to see something more than this. Because the poet does not specify what the two roads represents. The poet has used many words, phrases and lines which have got symbolic meanings relating to his feelings and characteristics. You have to explore the symbolic meaning of the poem as well as the feelings, characteristics and life pattern of the poet from the poem.

III. Cognitive Apprenticeship

In this stage students serve as apprentices to teacher to master observation, interpretation and contextualization. Teacher acts as a facilitator by providing activities, hints and advices that call for authentic problem solving in settings. Teacher will pose problems in the form of following questions through Power Point presentation in the context of each stanza so as to enable students to explore solutions (answers) collaboratively.

Power Point Presentation

Stanza: 1

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveller, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;

Problem posing questions

1. Who is the traveller?
2. Where was he travelling?
3. What did he see in the yellow wood?
4. What is the meaning of undergrowth? (from the Dictionary)
5. What did he do?
6. If, poet : yellow wood,
   then, human beings : ________
7. What would be the symbolic meaning of 'yellow wood'?

8. What would be the symbolic meaning of 'two roads'?
9. What is the meaning of 'looked down one as far as I could' and what could be its symbolic meaning?

Power Point Presentation

Stanza : 2

Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear,
Though as for that the passing there
Had worn them really about the same.

Problem Posing Questions

1. What was the condition of the second road?
2. Which road that the poet chooses to travel?
3. Whether it was easy or difficult one? Justify your answer citing words and phrases from the stanza.

Power Point Presentation

Stanza : 3

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

Problem Posing Questions

1. Find out the similarities and differences between two roads. Justify your answers providing evidences from stanza 2 and 3.
2. What was his doubt and why did he doubt?

Power Point Presentation

Stanza : 4

I shall be telling this with a sigh
Somewhere ages and ages hence
Two roads diverged in a wood, and I –

I took the one less travelled by,
And that has made all the difference.

Problem Posing Questions

1. To whom the poet is telling?
2. What does the word 'sigh' imply here?
3. What does he tell?
4. The poet says 'I took the one less travelled by and that has made all the difference'. What is 'the difference' that the poet mentions?

Power Point Presentation

Explorative Questions

1. Was the poet happy about his decision? Justify your answer giving evidences from the poem.
2. From the title 'The Road Not Taken', tell about the feelings of the poet.
3. Did he choose the road on his own or by the pressure of others? From your answer tell the personality of the poet.
4. What is the rhyme scheme of the poem? In line 19-20, does 'difference' rhyme precisely with 'hence'? Predict poet's life pattern from the rhyme scheme.
5. Predict the personality traits of the poet from the poem. Justify your answer sighting evidences from the poem.
6. State as many as pairs of choices which represent 'Two Roads' symbolically.
7. Do those choices precisely match the descriptions of the 'two roads'? If the answer is yes, then why and if it is no then why not?
8. Which line or stanza do you like most and why?

IV. Collaboration

Teacher will form heterogeneous groups consisting of 5-6 students in each group to explore answers to the problem posing questions and explorative questions presented to them in step III collaboratively while teacher helps them if required.

V. Interpretation Construction

Students discuss themselves and construct interpretations observing contextual materials and background illustrations including text book and dictionary. They write their answers and arguments in their note books with evidences for the validity of their interpretations.

VI. Multiple Interpretations

Teacher asks representatives of each group to present the group interpretations before other groups one after another and initiates discussion among them. Students gain cognitive flexibility by being exposed to multiple interpretations, arguments and counter arguments.

VII. Multiple Manifestations

In this step the entities of the text (e.g., words, lines, stanza, title etc.) can be manifested in different ways in the text. Following questions will be asked to the students for multiple manifestations.

Power Point Presentation

Questions

1. Give any other title to the poem 'The Road Not Taken'.
2. Create a new stanza which can substitute the first stanza.
3. Explore words which can rhyme with each other in stanza 3.

Further Search

The students will be asked to search the following web sites to know more about Robert Frost and his poems.

- www.poets.org/poets/poets.cfm?ptmID=1961
- www.poets.org/poems/poems.cfm?prmID=1645
- www.geocities.com/Athens/Olympus/1487/index.html
- www.bartleby.com/119/1.html-19k
- www.en.wikipedia.org/wiki/The-Road-Not-Taken-19k
- www.wsu.edu:8080/~wldciv/world-civ-readav/world-civ-reader-2/Frost-read.html-4k
- www.poet.org/viewmedia.php/prmMID/15717-76k
- www.youtube.com/watch?v=yG24ohpac
- www.ketzle.com/Frost/roadnot.htm-2k-
- www.ketzle.com/Frost/-14k
- www.online-literature.com/Frost/-45k-

EXEMPLAR IN ENGLISH

Prof.S.M.Pany
Former Professor & Principal
RNIASE, Cuttack

Ms. Amrita Pritinanda
Research Scholar
RIE, NCERT, Bhubaneswar

Subject : English (prose)
Class : IX
Duration: 60 minutes
Topic : Kathmandu (paragraphs 1-4)

Process Based Objectives:

- To enable the students to develop reflective thinking, originality, open mindedness.
- To enable the students to construct and develop new concepts.
- To enable the students to learn and use language skills for meaningful communication.

Content Based Objectives:

- To enable the students to read and comprehend the theme of "Kathmandu" while reading silently.
- To enable the students to answer to the questions in their own language both in oral and written form when asked from the theme of the topic.
- To enable the students to enhance their vocabulary using suffixes and prefixes.
- To enable the students to correct punctuation marks in any given context.
- To enable the students to form and use nouns from verb and vice versa.

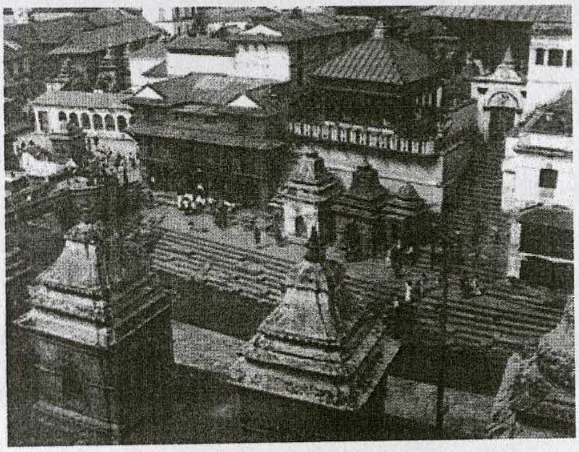
For Example: Proclaim --- Proclamation

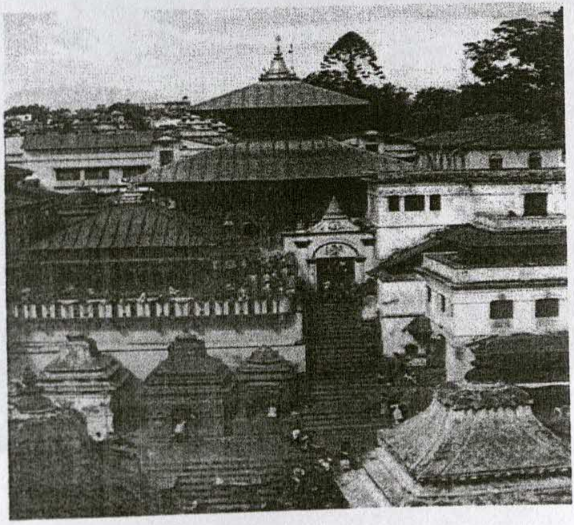
I. Observation

Learning Situations:

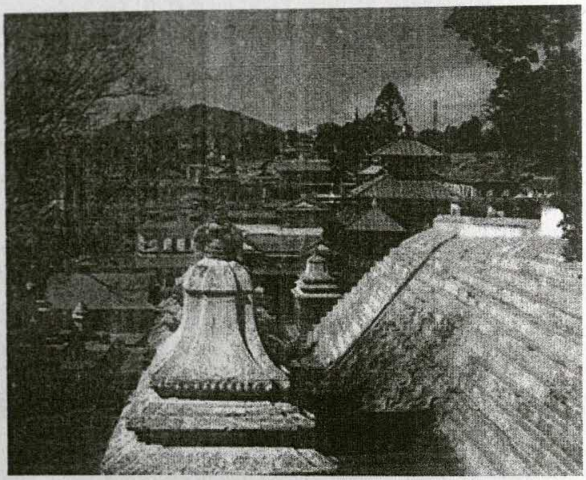
1. The teacher will ask the students to describe the places they have visited. This description may include the mode of conveyance; transport to the place, the importance of the place, its surroundings etc.
2. The teacher can also show a video recording or a film on Kathmandu and then discuss with the students.
3. In case the video programme is not available, the teacher can collect the photographs of the city of Kathmandu and different important places of the city. These can be collected from the news paper, magazine etc.

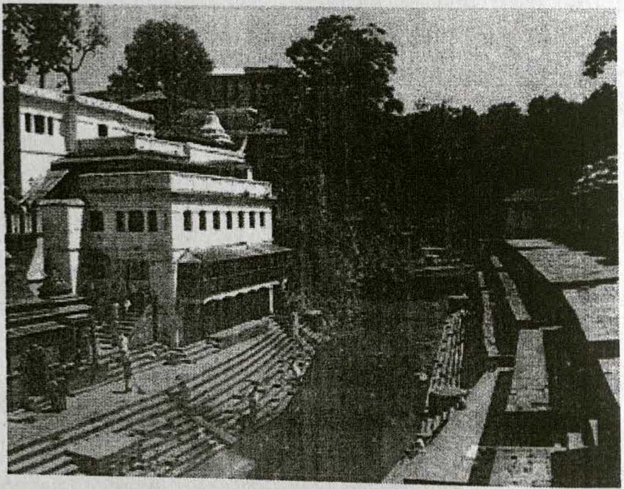
PASHUPATINATH TEMPLE



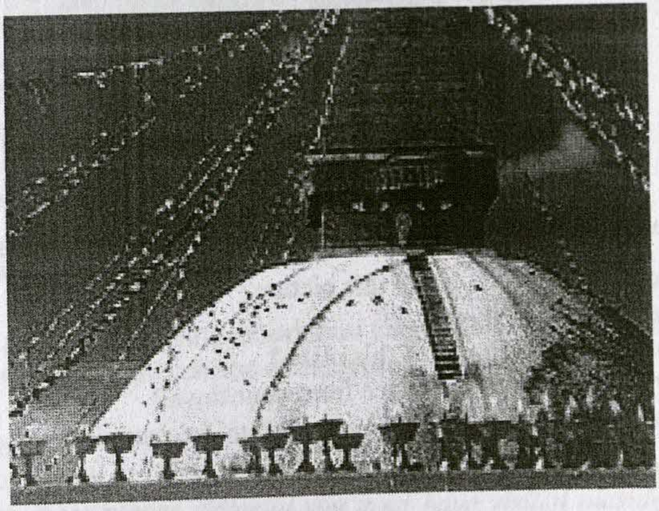


PASHUPATINATH TEMPLE





BOUDHNATH STUPA



MARKET PLACES IN NEPAL

To initiate the discussion the teacher can ask the following questions:

1. Which Place do you see in this picture?
2. Have you visited this place?
3. What is the importance of this place?
4. How can you reach this place from your town?
5. Locate this place in the map. (map should be provided)

Silent Reading of the Text by the Students

The students will read the text silently. In the mean time the teacher will give the meanings of difficult words in power point presentation.

Dictionary Meaning of Words

Sacred: (adj.) 1. Religious
2. Connected with a god or goddess,
3. Divine, holy, dedicated
4. An act of giving up something one values for the sake of something that is important.

(v) Sacrifice
Proclaim: (v) 1.Announce officially or publicly
2. Declare (someone) officially or publicly to be,
3. Show clearly,
4. Advertise.
(n) Proclamation.
Convince: (v) 1. Announce to believe firmly in the truth of something,
2. Persuade to do something,
(adj.) convincing-1.able to convince,
2. Learning no margins of doubt.
Protrude: (v) 1.Extend, project, hang out,
2. Stick out beyond or above a surface,
(n) Protrusion.
Immense: (adj.) 1.very large or great,
2. Enormous, giant,
(n) Immensity,
(adv.) Immensely.
***Mercenary*:** (adj.) 1.motivated chiefly by the desire to make money.
(n) a professional soldier hired to serve in a foreign army, fighter.
Adorn: (v) 1.make more attractive or beautiful,
2. Decorate
(n) Adornment.
Indulge: (v) 1.allow (someone) to do or have whatever they wish.
2. Satisfy (a desire or interest),
3. Allow one to enjoy the pleasure of.
(n) indulgence-1.the action of indulging in something,
2. Willingness to tolerate another's faults.
(adj.) indulgent-easy-going, kind, patient.

II. Contextualization

The teacher will give the following description about the background of the prose so that the students will relate the context of the prose with the description.

> *You must have visited some of the important places like Ajmer Sharif, Madurai, Sanchi, Varansi, Saranath in India. You must have enjoyed by visiting those places. Some of you must have visited outside India places like Kathmandu in Nepal. If you have not visited let us read and find out some of the interesting facts about the city. You will be pleased to know that Kathmandu is a very beautiful place full of varieties of sceneries. Both Hindu and Buddhist culture reign over the city. People are very religious, simple in their life.*

With this description the students will try to correlate the portions of the text they have read and the background material. They will contextualize their previous knowledge to the present context.

II. Cognitive Apprenticeship

The teacher will model how to integrate reading the text, watching the pictures, referring dictionary for interpretation. Under the direct observation of the teacher, the students proceed through observation, contextualization, and collaboration. The teacher will give comprehension questions in power point presentation to ensure the progress of the students.

The questions will be taken from each paragraph of the portion of the text to be covered. The questions will be there to test the language skill, grammar competence and comprehension.

Here are the questions:

A. Paragraph 1 and 2

1. Where does the author get a cheap room?
2. The proclamation of Pashupatinath temple says:-
3. Explain: "febrile confusion".
4. Who are roaming through the grounds?
5. People are trying to get attention of the priest. Why
6. A fight begins between two monkeys.
   Give the word to replace the underlined word.
7. What is the belief at Pashupatinath temple about the end of Kaliyug?
8. Describe the scenes at the bank of the river Bagmati.
9. ......a party of saffron-clad westerners struggle ....
   Give the meaning of the underlined word.
10. The policeman is not convinced.
    Give the opposite meaning of the underlined word.

Paragraph-3 and 4

1. Compare the atmosphere at Pashupatinath temple and at the Buddhnath stupa.
2. Why Kathmandu is considered as city full of vividness?
3. I indulge myself mindlessly.
   Make a sentence out of the underlined word.
4. The writer says, "All this T washes down with Coca Cola", what does "all this" refer to?

B. Grammar Work

1. Use the suffix –ion or –tion to form nouns from the following verbs. Make the necessary changes in the spellings of the words.

For Example: proclaim- proclamtion

Cremate-
Invent-
Exhaust-
Direct-
Imagine-
Associate-

act-
tempt-
immigrate-
mediate-
dislocate-
dedicate-

Pick out the nouns like proclamation from the context.

2. Identify the punctuation marks like full stops, question marks, commas and inverted commas from the given context.

IV. Collaboration

The teacher will form 5 heterogeneous groups consisting of 5 to 6 students in each group, in the classroom. The students will have to work in groups to interpret the paragraphs (1 to 4) taken from the text. Each and every member of each group will participate in team work. They will correlate the text(portions for today) with the teacher's description and the background material and answer the questions put by the teacher in step-III.

The answers for grammar work part-1 may vary due to the spellings of the words. The teacher here will accept the most appropriate and correct answer and discard the others. The other answers will also be treated equally as grammar -1 will have been treated.

V. Interpretation Construction/Multiple Interpretations

The students will be allowed to interpret the text by their own. They will note down their interpretations, new ideas in their note books. Beside the interpretation they may come out with new ideas which the teacher could have not expressed. They will discuss among themselves and arrive at a common conclusion. The students will be told to present it group wise before the class. So that appropriate answers will be recorded and inappropriate answers will be discarded. These will be multiple interpretations on certain points such as:-

1. We can enjoy the traveling in various ways.
2. The author (Vikram Seth)'s description on his visit to Kathmandu.

VII. Multiple Manifestations

The interpretations of the students will be manifested in multiple ways. The teacher will provide certain tasks for multiple manifestations. The students will be directed not to work in group for this purpose.

A. Being a traveler describes your experience in a beautiful city you have visited.

B. You have framed noun form of verbs by adding –ion or –tion. Use these noun forms in a new context and fill in the blanks.
[Cremation, action, exhaustion, invention, temptation, immigration, direction, meditation, imagination, dislocation, association, dedication]

1. Mass literacy was possible only after the __________ of the printing machine.
2. Ramesh is unable to tackle the situation as he lacks ____________.
3. I could not resist the ___________ to open the letter.
4. Hard work and ________________ are the main keys to success.
5. The children were almost fainting with __________________ after being made to stand in the sun.

C. Following the task –A, Change the nouns into verbs and rewrite the sentences given in the task.

D. Use capital letters, full stops, question marks, commas and inverted commas wherever necessary in the following paragraph.

An arrogant lion was wandering through the jungle one day he asked the tiger who is stronger than you O lion replied the tiger who is more fierce than a leopard asked the lion you sir replied the leopard he marched up to an elephant picked him up in his trunk swung him in the air and threw him down look said the lion there is no need to get mad just because you don't know the answer.

After the correction feed this paragraph to the computer and check with in built word correction of the computer and assess the extend you corrected the paragraph.

- www.lonelplanet.com/nepal/kathmandu-82k
- www.en.wikipedia.org/wiki/kathmandu-100k
- www.travemasti.com/international/nepal/kathamndu.htm.-23k-
- www.bharatonline.com/nepal/tourist-attractions/kathmandu/index.html-57k-
- www.youtube.com/watch?v=gx12wzsQity

EXEMPLAR IN ENGLISH

Dr.Harihar Sarangi
Reader in Education
P.G.Dept. of Education
G.M.College, Sambalpur

Ms. Amrita Pritinanda
Research Scholar
RIE, NCERT, Bhubaneswar

Subject : English (Prose)
Class : IX
Duration : 60 minutes
Topic : The Sound of Music (Paragraphs 1 to 5)

Process Based Objectives:

The student will be able to:

i. Develop ability to interpret the newly learnt words in multiple ways.
ii. Evaluate, summarize and communicate information meaningfully from the text.
iii. Develop reflective thinking while asked conditional questions in any given context.
iv. Develop reflective thinking.
v. Explain the inherent meaning of lines/part of lines.
vi. Acquire language skills
vii. Develop ability to work in group successfully.
viii. Develop ability to use the media and technology in his/her study.

Content Based Objectives:

The student will be able to

- Explore and/or refine the existing structures about the meaning of such words as; jostle, rush, note, nervous, conceal, impaired, pursue, urge… etc. from the dictionary those best suit to the content of the text.
- Use "to+infinitive" form of verb even in unfamiliar situations.
- Infer the learning of different activities appropriate for different kinds of disabilities.
- Use newly learnt words such as conceal, daunt, urge, gradual, jostle, nervous in writing.

Learning Procedure

The procedure is totally based on ICON (Interpretation Construction) Model.

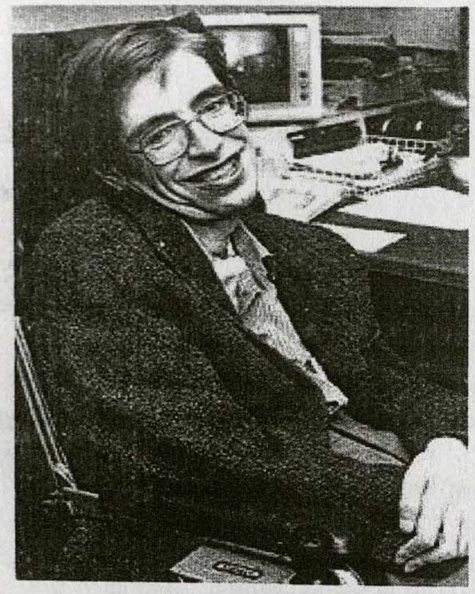
I. Observation

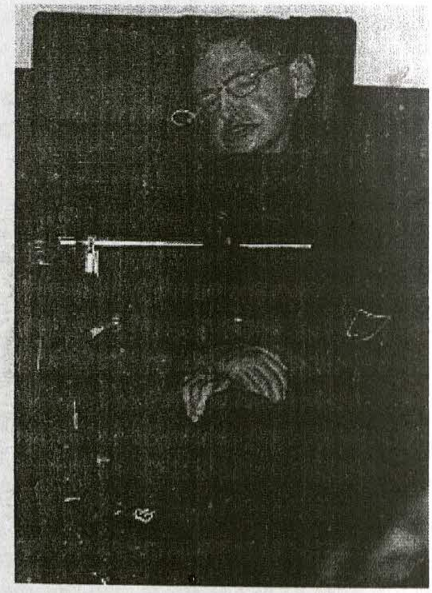
Learning Situations

(a) The teacher will give a power point presentation on persons having physical disability but famous in their fields. The presentation will show pictures of those persons with brief description about them at right side.

Description along with photos:

Stephen Hawking





- He was a British Physicist.
- He was known for his book "A Brief History of Time."
- He worked in the field of theoretical cosmology, quantum gravity, and relativity.
- He was in the news in July 2004 for presenting a new theory about black holes.
- He was severely disabled by motor neuron disease.
- He was using Voice Synthesizer to communicate.
- But he described himself as "lucky" as he was getting family support.

Theodore Roosevelt

- He was the 26th president of the United States.
- He was an historian, a biographer, a statesman, a hunter, a naturalist, and an orator.
- His prodigious literary output includes 26 books, over a thousand of magazine articles, thousands of speeches and letters.
- He was small and weak looking from his childhood.
- He suffered from poor eyesight, asthma and polio.
- Through his own self education through reading, he was accepted to Harvard University.
- He died of his lifelong fight with polio and asthma. He restricted to the use of a cane or a wheelchair at the end of his life.

John Milton

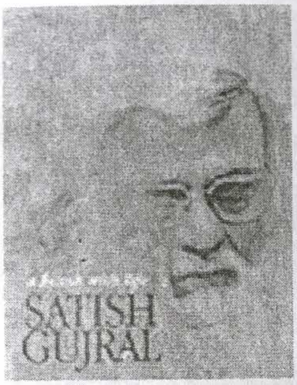
- A renowned writer of English Literature.

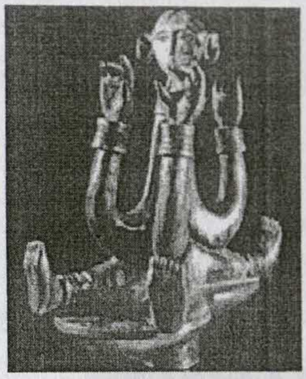
- In 1952, he lost his sight. This prompted him to write the sonnet, “When I consider How my light is spent”.
- He was an English poet, prose, and polemicist.
- He is known for epic poem Paradise Lost.
- By the time of his death in 1674, Milton was blind, impoverished and yet unrepentant for his political choices.

Helen Keller

- he was an American author, political activist and lecturer.
- She was not born blind and deaf; it was not until she was nineteen months old that she contracted an illness described by doctors as "an acute congestion of the stomach and the brain," which left her deaf and blind.
- She was the first deaf blind person to earn a B.A. degree.
- The film “The Miracle Worker” depicts the role of Keller’s teacher, Anne Sullivan (how she broke through the isolation imposed by a near complete lack of language) allowing the girl to blossom as she learned to communicate.
- She campaigned for women’s suffrage, worker’s rights and socialism, as well as many other progressive causes.

Satish Gujral

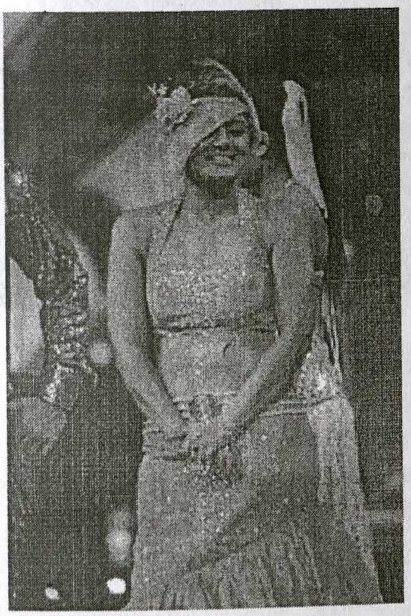




Satish Gujral and His works:

- A painter, sculptor, muralist, architect and famous writer.
- Mostly described as a living legend in the field of art.
- He is the brother of former prime minister of India Mr. Indra Kumar Gujral.
- He is profoundly deaf and dumb.
- He has overcome his loss of hearing and used his potential in painting, art.
- There are some art created by Satish Gujral are being given here.

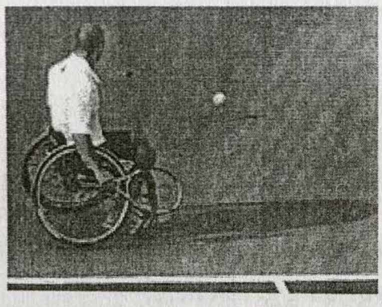
Sudha Chandran

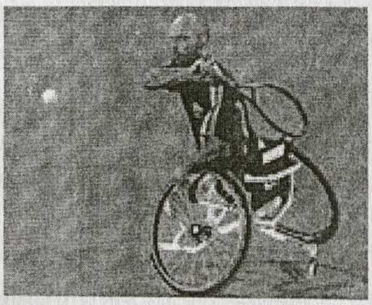


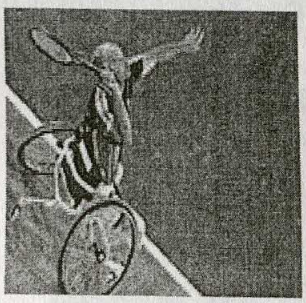
- She is a well known Bharthnatayam dancer, versatile actress of big as well as of small screen.

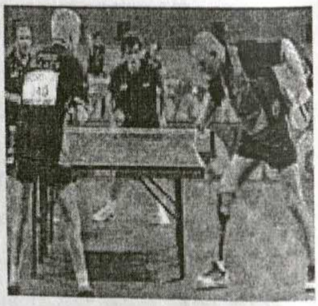
- She lost her leg in an accident in 1986. But she was determined to learn the difficult dance form of Bharathnatayam.
- The movie Nacche Mayuri (1986) was inspiration of her life.
- She herself played the lead role in the movie.
- She says, "I vowed to become someone big". "My inspiration has come from my failures."
- Many prizes, awards she has collected into her pocket. Now she continues to reign over the small screen.

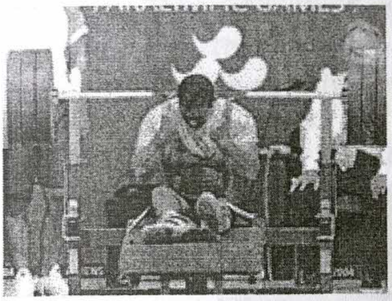
Athelets of Paraolympics Games-2008

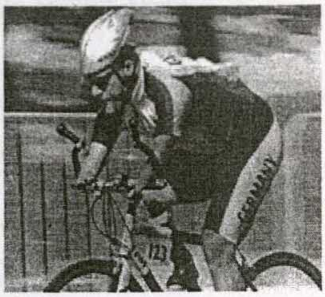


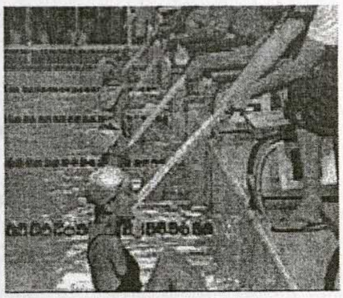












- With the help of wheel chair they have to play lawn tennis, table tennis.
- Even if they are visually impaired, they can perform better than their opponent in Judo.
- Visually impaired athletes also take part in swimming.
- With a slight disability in arms they have taken part in power lifting.
- Athletes with cerebral palsy, balance difficulties, visual impairment, physical disability with arms, legs, have taken part in cycling.
- They have won medals for their country.

Jessica Coass

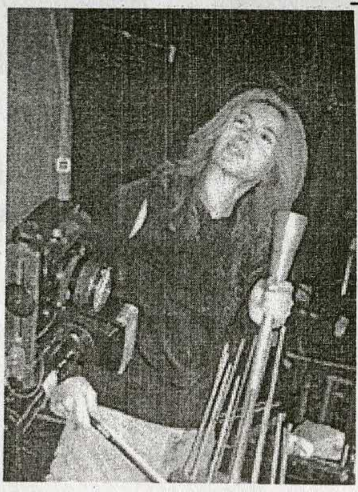
- She is a pilot.
- She drives the plane with her legs.

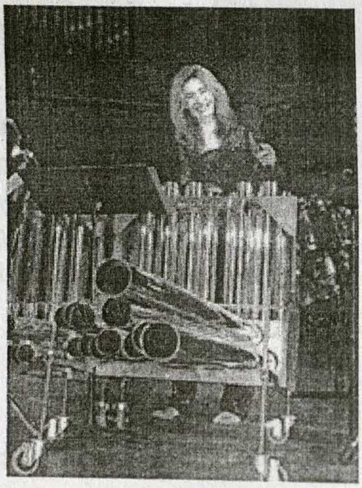
- She is having black belt in Taekondo.
- She can drive the car; wear contact lenses with the help of her legs.
- She is getting now the training to be a flying instructor.

Louis Braille

- He was the inventor of Braille, a world-wide system used by blind and visually impaired people for reading and writing.
- He became blind at the age of 3.
- A bright and creative student became a talented cellist and organist in his time at the school, playing the organ for churches all over France.
- He died in Paris of TB in 1852 at age of 43.

Evelyn Glennie





- This girl is the first full time solo-professional percussionist in 20th century western society.
- She has already given over 100 concerts a year as well as master classes in music schools.
- She regularly plays barefoot for live performances and studio recording.
- She feels the music without hearing it.
- She refused to accept rejection of her desire to become a solo percussionist.
- She says, "I'm not a deaf musician. I'm a musician who happens to be deaf."

After the presentation is over, the teacher will ask a few questions to the students in groups. They will be told to discuss and arrive at a common conclusion.

Teacher:

1. All these people (in pictures) are from different fields. But something is common among them. Can you identify it?
2. What is your opinion, how they have achieved a lot in their respective fields?

OR

(b) If possible the teacher can arrange a film show of Hindi film **"BLACK"**. Some of the clippings of the film can be shown to the students which are related to the text. After the show there will be discussion among the students that how they can correlate the film clippings to their text.

The students will discuss among themselves in groups and find out the answers. From their correct answers the teacher will proceed towards the topic. He will say:- The last photo in presentation is of Evelyn Glennie, who listens to sound without hearing it. You can find more about her from the chapter: The sound of Music (part-1)

Silent Reading by the students

The students will read the paragraphs (1 to 5) silently. The teacher will give the meaning of difficult words as they are in dictionary through power point presentation.

Dictionary Meaning of Words

Conceal: (v) prevent from being seen or known, hide, keep secret, suppress.
(n) Concealment.
Daunting :(adj.) Depress, discourage, and cause to feel nervous or discouraged.
(v) Daunt.
Gradual : (adj.)1.taking place in stages over an extended period,
2. (Of a slope) not steep.

(adv.) gradually.

Jostle: (v) 1. Push or bump against roughly.
2. (Jostle for) struggle forcefully for,
3. Crowd in on

Nervous: (adj.) 1. Easily frightened or worried.
2. Anxious, disturbed. 3. Having to do with the nerves.
(adv.) nervously.
(n) Nervousness.

Note: (n) 1. A brief written record used as an aid to memory.
2. A short written message or document.
3. A single sound of a particular pitch (in music),
4. A particular quality.
(v) 1. Pay attention to,
2. Record in writing.
(adj.) noted.

Pursue: (v) 1. follow an order to catch or attack,
2. Try to achieve (a goal)
3. Engage in or continue with (an activity)
4. Continue to investigate or discuss.

Rush: (v) 1. move or act with urgent haste,
2. Transport with urgent haste,
3. Deal with too quickly,
4. (Air or liquid) flow strongly,
5. Try to attack or capture (a person or place) suddenly.
(n) 1. A sudden quick movement,
2. A sudden strong feeling,
3. A marsh or waterside plant.

Spot :(n) 1. A small round mark on a surface,
2. A pimple,
3. A particular place, point, or position.
(v)1. Notice,
2. Recognize,
3. Mark with spots
(adj.) spotted.

Urge: (v) 1. encourage or ask earnestly to do something,
2. Strongly recommend,
(n)1. a strong desire or impulse,
2. Hunger, inclination.

Impair: (v) 1. weaken or damage,
2. Spoil, harm
(n) Impairment,
(adj.) impaired.

II. Contextualization

The students will relate the background material with the text and the in formations given by the teacher. The teacher will give the following description about the text.

You have seen the pictures and read the information about the physically disabled persons in PowerPoint presentation. They are famous in their respective fields. It is because their positive attitude. They very much aware of their loss, so they divert their attention towards their potential for achieving something. Their hard work and determination make them different from others. Even if they have lost something they have tried to compensate it in other ways. Let us learn about Evelyn Glennie, who is a deaf but famous as a percussionist in the world of music. Whenever she comes to perform, she comes to the stage barefoot, so that she can feel the music without hearing it.

If the students will be shown the film clippings then the teacher has to give different description:

The film shows a character of a blind, deaf, dumb girl. The girl from her very childhood was helpless. Except her mother no body could understand her. It was up to the day when a new man came to her life as her mentor. She fought and came out to see, hear and feel the new world. A very similar character you are going to read. Let us learn about Evelyn Glennie, who is a deaf but famous as a percussionist in the world of music. Whenever she comes to perform, she comes to the stage barefoot, so that she can feel the music without hearing it.

From this description the student may contextualize and arrive at a conclusion that:- Though physically disabled persons have lost one part of their body still they manage to achieve success due to their strong determination and hard work.

The students can be told to give examples of such personalities from their locality.

III. Cognitive Apprenticeship

The teacher will model how to integrate reading the text, watching the pictures, referring dictionary for interpretation. Under the direct observation of the teacher, the students proceed through observation, contextualization, and collaboration. The teacher will give comprehension questions in power point presentation to ensure the progress of the students.

The questions will be taken from each paragraph of the portion of the text to be covered. The questions will be there to test the language skill, grammar competence and comprehension.

Here are the questions:

A. Paragraph-1

1. Who were taking position on the train platform to board the train?
2. Give suitable words/phrases to replace "rush hour crowds".
3. The girl was going to __________.
4. Explain the line- "she was nervous yet excited."
5. Who was the aspiring musician at a tender age in the context?
6. What was the big challenge for Evelyn?
7. Which word in the paragraph expresses the opposite meaning of 'encourage'?

Paragraph-2

1. Evelyn's loss of hearing had been gradual.
Give the antonym of the underlined word.
2. Change the form of word gradual.
Keeping it at the beginning rewrite the sentence in No.1.
3. Evelyn managed to conceal her growing deafness.
Replace the underlined word with another suitable word.
4. Why couldn't Evelyn manage to conceal her deafness?
5. What was the cause of her deafness?
7. Why did everything suddenly look black for Evelyn?

Paragraph-3

1. Evelyn didn't stop making effort to lead a normal life.
What is the word/phrase used in the text for the underlined words?
2. Why did Evelyn decide to learn music?
3. _________ spotted Evelyn's potential for learning music?
4."Don't listen through your ears"- who said to whom? And why?
5. Try to sense it in some other way. What is this some other way meant for?

Paragraph-4 and 5

1. When did Evelyn decide to make music her life?
2. How did she make a history in the field of music?
3. She had captured most of the awards.
Give the meaning of underlined word.
4."If you work hard and know where you are going, you'll get there." What did Evelyn mean by the word "there".

B.Grammar Work

Identify to+infinitive form of verbs in the sentences. Pick out the lines and underline the structure.

For Example: to+learn, to+go.

IV. Collaboration

The teacher will form 4 to 5 heterogeneous groups consisting of 5 to 6 students in each group, in the classroom. The students will have to work in groups to interpret the paragraphs (1 to 5) taken from the text. Each and every member of each group will help to answer the questions put by the teacher in step-III.

For Example: The answers will come in different ways when the students attempt to answer the grammar activity that is "to+infinitive". The most appropriate answer will be chosen by the teacher. Like this all other questions will be treated.

V. Interpretation Construction

VI. Multiple Interpretations

The students will be allowed to interpret the text by their own. They will note down their interpretations, new ideas in their note books. They will discuss among themselves and arrive at a common conclusion. There will be multiple interpretations on certain points such as:-

i. The person with physical disability is different from the normal person.

ii. Evelyn Glennie listens the music without hearing it.

iii. In grammar activity they will derive the conclusion that after 'to' always come 1st form of verb.

VII. Multiple Manifestations

The interpretations of the students will be manifested in multiple ways. The teacher will provide certain tasks for multiple manifestations.

1. If Evelyn Glennie was a blind, what would have been the effect on her learning of music?
2. Help Evelyn to justify her decision of making music her life?
3. Use appropriate from of the words from the box given below to fill in the blanks. [Jostle, spot, urge, gradual, rush, nervous, conceal, impaired, daunt]

He was a famous player. He had a slight _________ in his legs. He could manage to learn the game. One day he found the crowd was ___________ into the field. He was ____________ but he had to _________ it. There was a _________ in the crowd to get his autograph. Though he was feeling _________ he was excited. ___________ the crowd started leaving the place and he felt relaxed. He could ________ a known face in the crowd. He tried to reach him. Because that person had discovered a _________ in him for learning the game.

4. There is some information given in the table below. You have to fill the columns as per your understanding.

Types of disability	Loss of part of body	Can do	Can't do	Can learn
Blind				
Deaf				
Dumb				
Physically disabled				
Mentally disabled				

5. Fill the column with to+infinitive form of verb and make meaningful sentences.

(a) The school sports team hopes ________.
(b) We all want ________.
(c) They advised the hearing impaired child's mother ________.
(d) The authorities permitted us ________.
(e) A woman decided ________.

These questions will be given to the students after the lesson is over. They have to answer these questions individually. There will be no group work further.

More you can find from:

www.en.wikipedia.org/wiki/john_milton
www.theodoreroosevelt.org
www.dailymotion.com/video/
www.evelyn.co.uk
www.bollywoodsargam.com/

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SCERT, Orissa

Sri Rajendra Kumar Nayak
Research Scholar
RIE, NCERT, Bhubaneswar

Subject : **Mathematics (Geometry)**

Class : **IX**

Topic : **Congruence of Triangles**

Duration : **1 hour.**

Learning Objectives

i. Learners will be able to differentiable among the figures or objects which are similar and which are congruent in nature by observation.

ii. Learners will be able to discover the conditions/rules for congruency of two triangles by estimation and comparison.

iii. Learners will be able to establish the general rules of congruency triangle under different conditions by means of practical demonstration, using different figures, aids & models.

Earlier concepts known to the children:

- Concept of Congruency
- Concept of similarity
- Concept of Triangle and varieties of triangles
- Concept of equality of angles/sides
- Concept of equality in all respects
- Concept of corresponding side and corresponding angle

Learning situation - I

The following tasks will be designed and carried by the teacher with the help of students to create learning situation in the classroom.

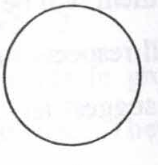
Task-1-Teacher will ask the students to write down the names of objects and draw pairs of figures or triangles which one similar in nature in their notepad. After sometime the lists prepared by the students will be read out one by one in the class. A sample final list of similar objects will be written on the black board and similar figures drawn by students will be drawn on a model worksheet by the Teacher.

Task-2-The sample copies of lists of objects and figures will be distributed in groups for discussion about the nature of similarity among objects or figures and the reasons there of.

Task-3- Teacher will provide a worksheet with a number of pairs of figures or triangles having similar and non-similar size on shape to all students and they will be asked to identify the pairs of triangles which are only similar in shape and which are both similar in shape and size.

Students will be asked to give name of figures given in worksheet of task -3 with same shape and size ----------- **congruent**

Work Sheet of Task-3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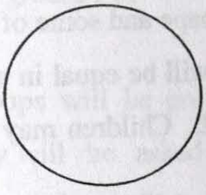
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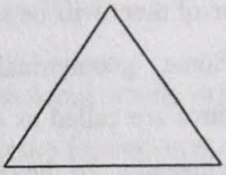
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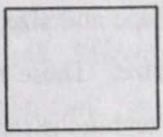
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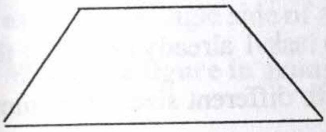
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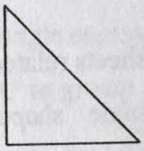
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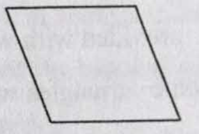
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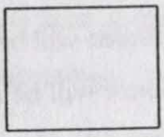
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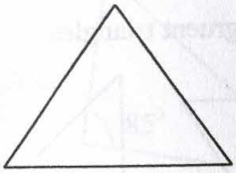
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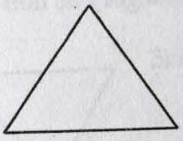
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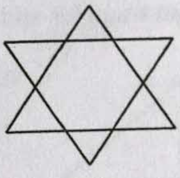
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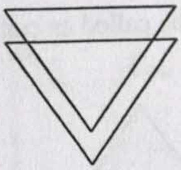
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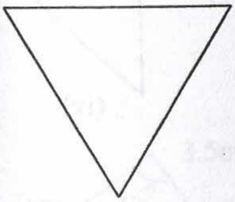
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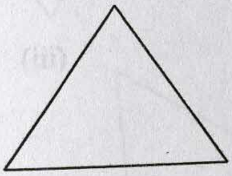
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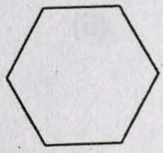
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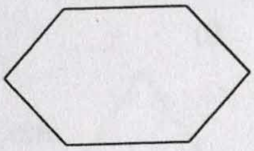
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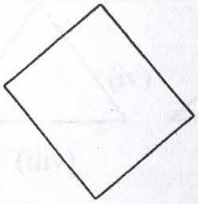
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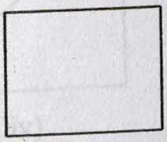
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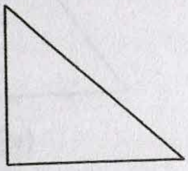
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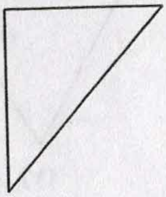

(xx)

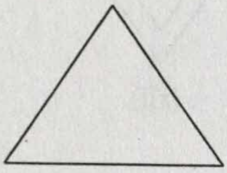
Learning situation – 2

Teacher will demonstrate a (power point presentation) video clip which describes varieties of figures. Some of them will be same in shape and some of them will be same both in shape and size. Some geometrical figures will be equal in all respects such as shape & size. These figures are called as congruent. Children may suggest any other name conveying the same meaning of the concept.

Learning Situation -3

Task-1

Children will be provided with worksheets related to task-1 already drawn by the Teacher. There will be some triangles with same shape with different size. Also there will be some triangles with same shape and same size. By observing the work sheet triangles the children will find out two category of triangles out of which one category will be called as congruent triangles and other category as non-congruent triangles.



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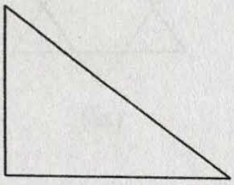

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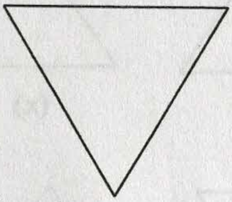

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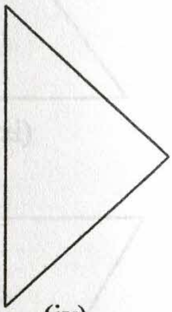

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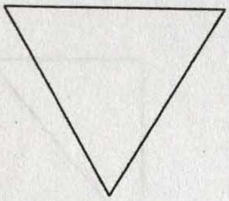

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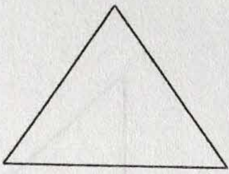

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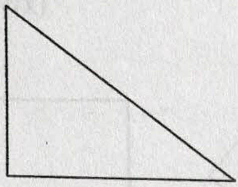

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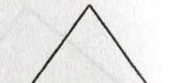


(viii)

Learning situation -3

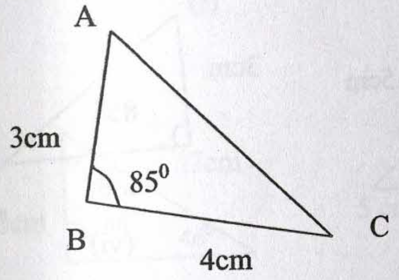
ASA-rule of congruency of *****

***Task* – 2**

Students in groups will be provided with work sheets with two different groups of triangles. They will be asked to match the figures on the basis of congruency and prepare a list and they will be asked to give reasons and draw conclusions. The conditions of congruency will be discussed by the Teacher to generalize the rule. Such as SAS side angle side of a triangle corresponds in another triangle to be congruent.

Match the figure in group 'A' to group 'B' on the basis of congruency:-

Group-A



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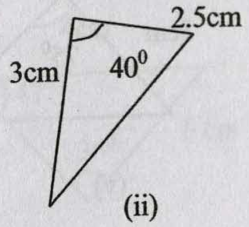

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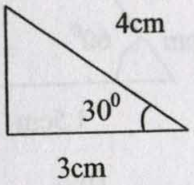

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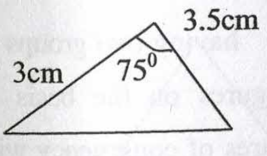

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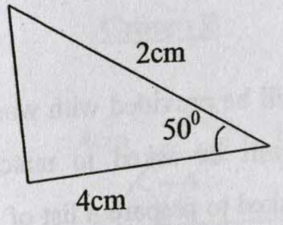

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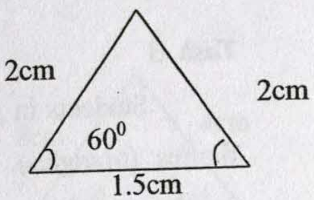

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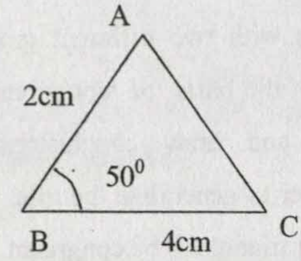
Group- B



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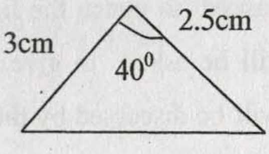

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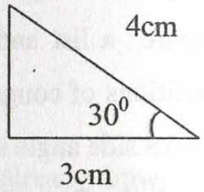

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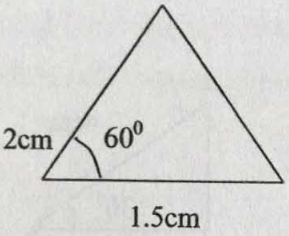

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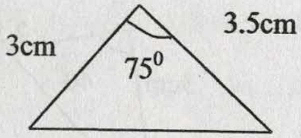

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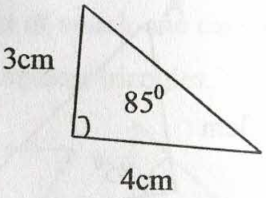


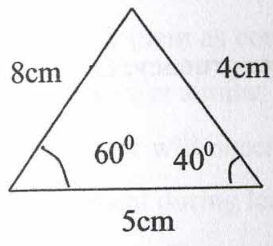
(vi)

Task -3

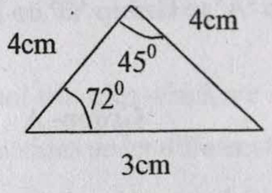
Students in groups will be provided with work sheets having two groups of figures (triangles). They will be asked to match the figures on the basis of congruency. They will be asked to prepare a list of such figures of congruency with reasons and draw conclusion about the congruency. The conditions under which the triangles were found to be congruent may be generalized by the Teacher. Such as ASA ----- Angle side Angle of a Triangle corresponds to ASA of another triangle

Match the figures in Group 'A' to Group 'B' on basis of congruency: (ASA) learning situation-3

Group- A



(i)



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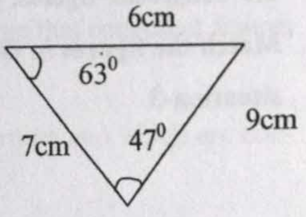

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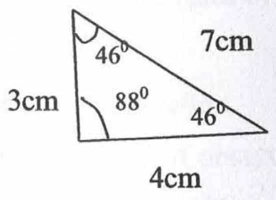

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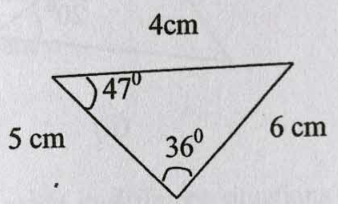

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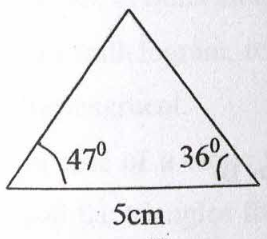
Group- B



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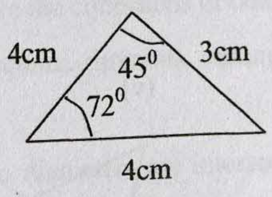

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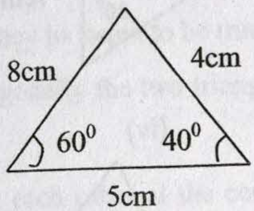

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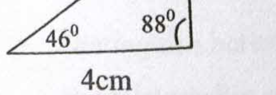

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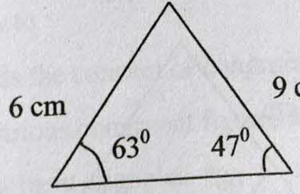


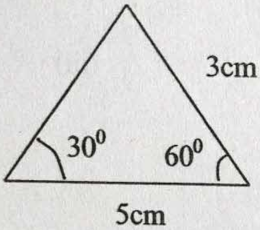
(v)

Task -4

Students will be provided with worksheets where five groups of triangles have been drawn with given measures of sides and angles. They will be asked to by the figures in both the groups and prepare a list pairs of triangles which are congruent. They will be asked to indicate reasons in each case and will draw conclusion after comparing all the congruent figures. (ASA **RULE)**

Match the figures in Group 'A' to Group 'B' on basis of congruency: (ASA) learning situation-3

Group- A



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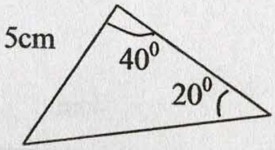

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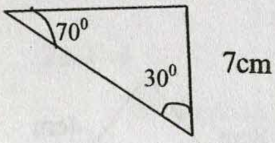

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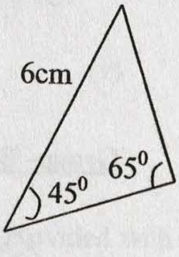
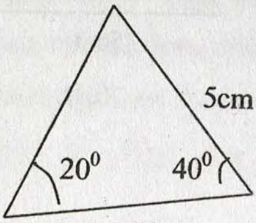
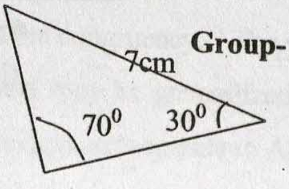


(v)

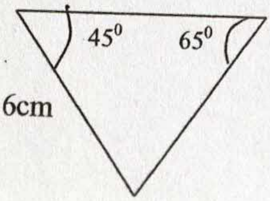
Group- B



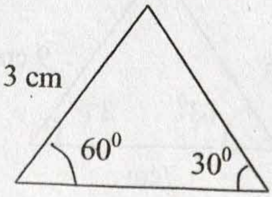
(1)



(2)



(3)



(4)

Observation:

- Students will be observing the given worksheet during learning situation; they may observe figures and objects and find out similar and non-similar figures. They may observe similar objects or figures of same shape and size. They may identify them as congruent figures. They may also observe that congruent figures are always similar in nature.
- .Children will observe different triangles which are congruent and which are non-congruent during learning situations under different tasks.
- Children will compare the congruent geometrical figures including triangles under different conditions.
- Children after careful observation of the measures in different triangles will find out the rules of congruency.

Contextualization

On the basis of observations made in different situations students will relate concept of congruency in different situations.

- .Criteria for congruence of triangles and apply the rules in equatorial triangles.
- .In congruence's of triangles corresponding parts are equal and same thing applied in case of other situation where the conditions of congruency in found to be true.
- In parallelogram, rectangle, square, rhombus, cutting diagonally the two triangles be congruent.
- In case of a circle where two diameters are intersection each other at the centre and the triangles formed by joining the end points, the concept of congruency is also applied.

Cognitive Apprenticeship

The teacher advices the pupils to

- State in their own words the concept of congruency in case of triangles.
- Distinguish between various congruent figures and deduce the relationship of congruent-triangles
- The children will be asked to draw two triangles

(i) With SAS condition and another two triangles

(ii) With ASA conditions of congruency of triangles and let that how out the measure of 3rd side in the first case and 3rd angle in the second case.

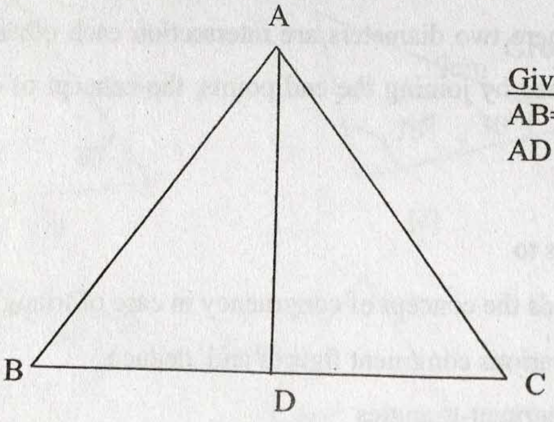
Collaboration

The students will be divided into heterogeneous group's 5-6 members in each and be assigned to prepare on:

- State the meaning of emergency and criteria for congruence of triangles.
- Paper folding of parallelogram, rectangle and rhombus to make no. of triangles which children in grants will be asked to estimate the area of rhombus by using congruence properties of triangles.
- Children in groups will be asked to show that the angles opposite to equal sides of Isosceles triangles are equal.
- Children in groups will be asked to estimate the area of rhombus by using congruence properties of triangles.

Interpretation Construction & multiple Interpretation

- .Make a kite having four triangles which are congruence to each other by using of paper, rope and stick.
- Children will be asked to examine the figure given below.



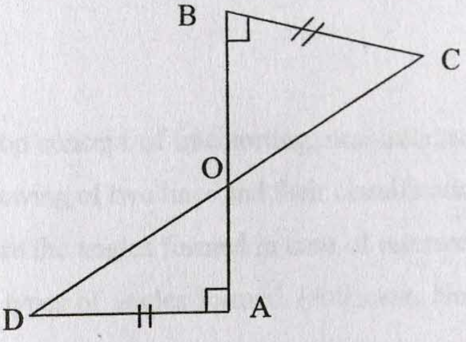
Given
AB=BC=AC
AD is perpendicular bisector of BC.

After examining the figure given above and scrutinizing the given conditions the children will be asked to answer the following question?

ABC & ACD triangles are required to the congruent under which rules of congruence.

Multiple manifestations:

1. AD and BC are equaled perpendicular to a line segment AB. Show that CD bisect AB.



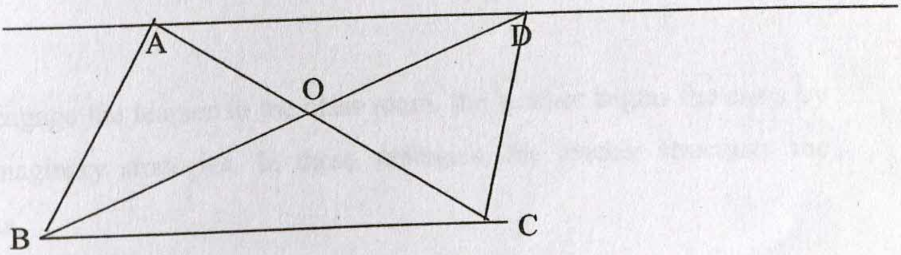
2. AB is a line segment and p is its mid point. D and E are points on the same side of AB such that, ∠BAD = ∠ABE and ∠EPA = DPB

Show that Δ DAP ≅ Δ EBP

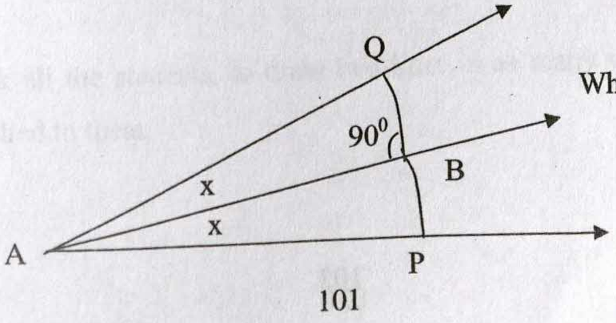
& AD = BD

3. Given AD//BC

ABC & DBC are two triangles formed on the common Base BC. What other criteria is required to conclude that the triangular ABC & DBO are on ground.



4.



Why Δ AQB ≅ Δ APB

- www.mathreference.com/geo.congru.html.-7k
- www.jimloy.com/geometry/congruen.htm-5k
- www.mathopenref.com/congruenttraingles.html-16k
- www.ies.co.jp/math/products/geo1/applets/cong.html-3k
- www.regentsprep.org/Regents/Math/congruen/Ltraingle.htm-18k
- www.wikipedia.org/wiki/congruence-(geometry)-34k
- www.argyll.epsb.ca/jreed/math9/standardf3/traingle-congruent..htm-18k
- www.cliffnotes.com/wiley coa/CLIFFS Riview Topic/Congruent Traingle.topicArticled-18851,article1d -187-88.html.-76k-

EXEMPLAR IN MATHEMATICS

Dr. Panchanan Das	Dr.D.C.Mishra	Sri Rajendra Kumar Nayak
Former Reader & Head	Former Dy Director	Research Scholar
DEE, RIE, NCERT	Directorate of TE &	RIE, NCERT,
Bhubaneswar	SCERT, Orissa	Bhubaneswar

Subject: Mathematics (Geometry)

Class : IX

Topic : Intersecting and non-intersecting of two lines.

Duration: I hour.

Learning objectives

i. Students will develop concept of intersecting, non-intersecting and Co-incident of lines (Though drawing of two lines and their classification)

ii. Students will explore the angles formed in case of intersecting of two lines and name, number and types of angles formed. (Adjacent, Non-adjacent, vertically opposite)

iii. Students will predict the measure of any two adjacent angles & relationship between any two non-adjacent (vertically opposite) angles with reasons.

iv. Students will discover logically the sum of all angles at the point of intersection of two lines.

Known concepts:

Straight lines (Parallels and nonparallel)

Angles: Supplementary, complementary, Adjacent, vertically opposite, linear pair (straight angles)

Learning situation:

To actively engage the learner in the class room, the teacher begins the class by using the guided imaginary strategies. In these strategies, the teacher structures the following no. of tasks.

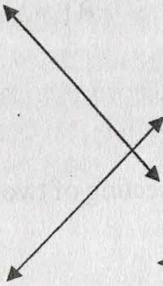
Task:-1:

Teacher will ask all the students, to draw two lines in as many ways as possible on a work sheet supplied to them,

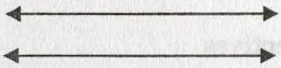
Task-2:

Working sheets from all the students will be collected. Then students will be asked to sit in groups. Collected work sheets will be given to different groups. The groups will be asked to observe the types of lines drawn in different sheets and classify them in a separate single sheet called as group classification format, such as

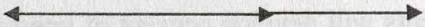
Intersecting lines:



Non-intersecting lines or parallel:



Co-incident lines:



Incase, some of the figures drawn by students don't come under the above three categories, then the teacher will provide feedback, through questions, models, video clips, so that by extending these figures will ultimately come under above specified category.

Task-3:

A sheet containing three types of lines drawn by students will be distributed in multiple copies. The students will asked to observe the figures and identify the figures in which angles are formed.

Teacher will ask the students to name the pairs of angles and to identify the maximum number of adjacent and non adjacent types, such as

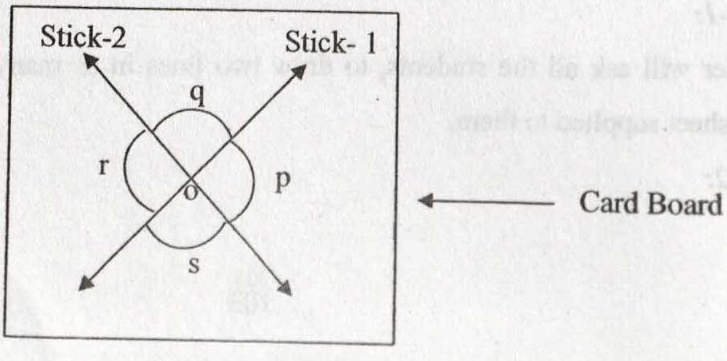
- 4 pairs of adjacent angle
- 2 pairs of non-adjacent angle

Task-4:

Model demonstration by teacher (Moving screwed two sticks at a particular point)

A cardboard containing screwed two sticks as shown below will be shown to the students.

FIG-I



Through observation of models or figures drawn on worksheets, students will be asked to discover the relationship between any pair of non-adjacent angles and adjacent angles. The following question may be asked-

Q1. What is the measure of any two adjacent angles?

Q2. What is relationship between any two non-adjacent or vertically opposite angles?

Task-5

Above relationship may established trough logical reasoning using expressions (1), (2), (3) & (4) as given below.

Teacher may help the students to derive the result through the following feed back questions. Students will also be provided with worksheets along with the figure-1 given above and will be allowed to write the expression after answering the questions.

What is the sum of angles p & q $\angle p + \angle q = 180^0$ .... (1)

What is the sum of angles q & r $\angle q + \angle r = 180^0$ .... (2)

What is the sum of angles r & s $\angle r + \angle s = 180^0$ .... (3)

What is the sum of angles s & p $\angle s + \angle p = 180^0$ .... (4)

Students will be asked to compare the relationship of sum of angles in (1) and (2), and (3) & (4).

After comparing (1) & (2) children will draw conclusion

That $\angle p + \angle q = 180^0 = \angle q + \angle r$ i.e. $p = \angle r \quad \angle q$

Similarly

Students will be given freedom to study the expressions (3) and (4)

Such as $\angle r + \angle s = 180^0$.......... (3)

And $\angle s + \angle p = 180^0$...... (4)

Draw the inclusion about $\angle r$ & $\angle p$ i.e. $\angle r = p$

Task-6:

Students will be encouraged to re look the worksheet containing fig-(I) with expressions (1), (2), (3) & (4) and answer the following questions-

What is the sum of $\underline{|p\quad} + \underline{|q\quad} = ?$ (Ans -$180^{0)}$

What is the sum of $\underline{|r\quad} + \underline{|s\quad} = ?$ (Ans-$180^{0)}$

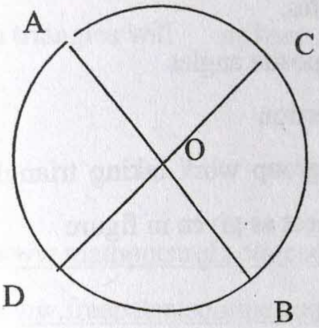
What is the sum of all above four angles at points 'O' (Ans-$360^{0?)}$

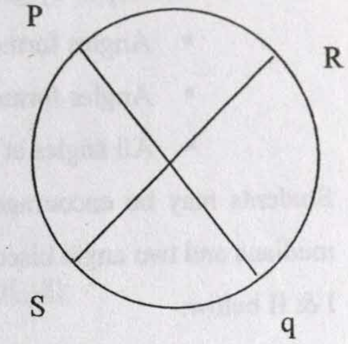
Observation

- Students will observe various ways of drawing two lines. They will classify the lines such as intersecting, non-intersecting and coincident lines.
- Students will observe the above three types of lines and find out figures where angles are formed.
- Further students will be asked to differentiate adjacent and non-adjacent (vertically opposite) angles.
- Students will re-look angles formed in the cardboard model and find out measures of any pair of adjacent angles and relation between any pair of vertically opposite angles and all angles at the point of intersection of two lines.

Contextualization:

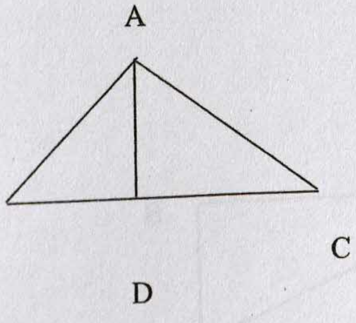
- Students will be encouraged to study other different geometrical figures where intersections of two lines are there and to find out the result established on above.
- Find out any other mathematical symbols in which two lines are intersected and results are also true.[sign of addition & multiplication, (+,X)] Find out any symbol in English alphabet where two lines are intersected and same result is found true (X).
- Students will be given a situation as described below will be asked to establish the result angles formed at the centre of circle by intersection of any two diameters and find out the validity of above relationship of angles.





Cognitive Apprenticeship

- Teacher will ask the children to prepare any other aid, depicting the principle involving vertically opposite angles are equal. (Diagonals of a square intersecting at a point)
- Teacher will ask the students to refer any available website where such principle of vertically opposite angles is utilized.
- ABC is a triangle with AD as its altitude is drawn on the sheet paper students may be asked to analysis to find out adjacent angles in the figure given and vertically opposite angles if any can they think of extending any line to create a figure having vertically opposite angles.



Collaboration

- Students in groups will be allowed to discuss about the patterns of figures already drawn in Task-I and they will identify the pattern of figures when angles have been formed.

- The students in groups will be required to study the patterns of figures already developed by group under three categories-such as
    - Angles formed as adjacent angles.
    - Angles formed as vertically opposite angles
    - All angles at the pointy inter section

Students may be encouraged to under take group work taking triangles with any two medians and two angle bisections in a work sheet as given in figure I & II below:-

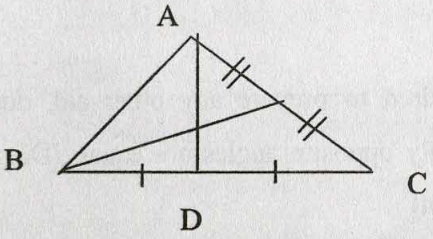


Figure-I

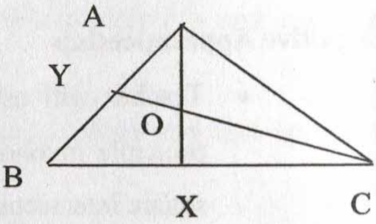


Figure-II

Interpretation construction and multiple interpretations

- Students will be given geometrical figure such as parallelogram trapezium with one of its diagonal and will be asked to draw any other line in each case, so that the properties established in case of adjacent angles, vertically opposite angles and the angles at the point of intersection are found true.

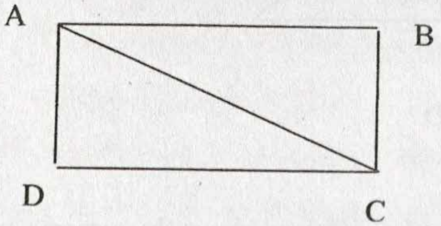


Fig-I

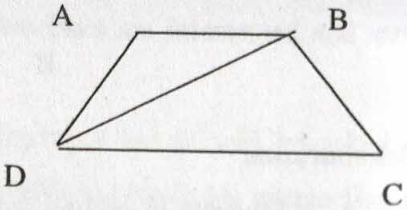


Fig-II

- Students will be encouraged to draw

(i) Two triangles with same base and same altitude and locate the point of intersection and vertically opposite angles.

(ii) Two triangles witl ne base and ss

- www.mathopenref.com/coordintersection.html-18k
- www.freepatentsonline.com/6236411.html-
- www.id.mind.net/~zonz/mmts/intersections/intersectionofTwoLines1/intersection Of Two Lines1.html-13k
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- www.me.metu.edu.tr/courses/me114/lecturers/descriptivex.htm-38k
- www.local.wasp.vwa.edu.au/~pbourke/geometry/lineeline

EXEMPLAR IN MATHEMATICS

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Class : X

Text Book: Math Text Book (NCERT)

Subject: Mathematics

Topic : Solving a pair of Linear Equation with two variables (Paired LET)

Duration: One and Half an hour

Learning Objectives:

1. **Content Based:**

After the class students will –

i. State the algorithm underlying solution of a Linear Equation with one variable (LEO)
ii. Establish the procedure of substitution method of solving a pair of Linear Equation with Two variables (LET);
iii. Solve paired LETs using the established procedure ;
iv. Explain how the Algorithm underlying solution of a LEO is extended to the case of LET.

2. **Process Based:**

During the instructional session students will be engaged in:

i. Meta cognition on their own understanding of the process of solving a LEO.
ii. Cognitive elaboration of the process of solving a LEO in terms of the constituent steps ;
iii. Relational thinking on LEO in contrast to LET and paired LET ;
iv. Interpretation construction.
v. Flexible interpretations of LET expressed as LEO and Vice-versa.
vi. Cognitive extension of the logic underlying and the process involved in solving LEO o the context of LET and paired LET.

Learning Situation

Students prior to this leaning are familiar with linear Equation with one variable (LEO) and the process of solving it. Teacher will present the following on a chart/ power point and initiates discussion with following lead points.

□ $2x + 3 = 15$……. (1)
□ $2x = 15 - 3$ …... (2)
□ $2x = 12$ ………. (3)
⇒ $x = 12 \square 2$ …….. (4)
⇒ $x = 6$…………….(5)

Leading Questions:

Students, You all watch the chart/presentation carefully. A problem has been worked out. Go through each of the 5 steps and examine each step in contrast to its previous step.

Leave children with sometime and lead out the discussion as given below.

1. What problem has been worked out?
2. What difference do you see in Step-2 as compared to Step-1?
3. How Step-3 is similar to and different from Step-2?
4. Can you see any similarity and difference between Step-4 and Step-3?
5. What difference do you see in Step-5 as compared to Step-4?

This discussion is likely to precipitate students' existing understanding of the process of solving a LEO.

Interpretation Construction:

Students, you all observed how a LEO has been solved. Now you discuss (in small groups) and try to explore **how you solve a LEO?**

Teacher may note that this task will stimulate metacognition among children. Here metacognition is of crucial importance because an average student may not be aware of the process involved in solving a linear equation with one variable (LEO) even though (s) he solves it on account of rote learning. The **algorithm** that solving a LEO involves separation of the variable from the constants and simplification must be explicit and distinct in the minds of the learners.

Students are likely to conclude the algorithm in their own words and not necessarily use terminology like '**Separation of the variable**' and '**Simplification**'. Teacher may assist students to refine their versions of these terminologies.

After this, the groups will continue to explore:

- The steps where isolation of variable has been carried out.
- The steps where simplification has been done in the given case.

Contextualization: (Cognitive expansion of LEO to LET).

Teacher will write the following two equations:

$10x - 15 = 45$ …….. (1) (A linear equation with one variable **LEO)**

$10\,xs + 3y+5=0$……... (2) (A linear equation with two variables – **LET)**

Students, look at these 2 equations. Can you say how these 2 equations are similar to and different from each other?

Students will be left with sometime to reflect upon the task. They may consult the neighboring classmates and hold deliberation to formulate their answers.

After reflection pupils will come up with their thoughts which are to be listed on the blackboard. Students' responses are likely to contain both critical & non-critical features of LEO & LET. The teacher may help students to focus on the most critical features – both are linear, and equation-1 has one variable but equation-2 has two variables.

What would happen to Equation-2 when one of the terms -10x and 3y vanishes?

Can Equation-2 be expressed in a form of Equation-1?

This will put students in **relational thinking** that is, linking LEO to LET.

Now ask the pupils to separate the variables (in small Groups of 3-4) of Equation-2. Some groups may isolate x and others y.

Student's performance may happen as:

$$x = (3y+5)\,/\,10 \qquad \textbf{(OR)} \qquad -\frac{(3y+5)}{10} = x$$

$$\text{and} \quad y = \frac{(10x+5)}{3} \qquad \textbf{(OR)} \qquad \frac{-10x+5}{3} = y$$

Teacher now lists the values of x and y along with Equation -2 (LET) as shown –

$$10\,x + 3y + 5 = 0 \text{ ………… (A)}$$

$$x = -\frac{(3y+5)}{10} \text{ ………… (B)}$$

$$y = -\frac{(10x+5)}{3} \text{ ………… (C)}$$

Students in groups will be asked to examine and conclude what way Equations (A), (B) and (C) are similar to / different from each other.

Teacher may assist the groups to understand:

- All are still LETs
- (B) & (C) each variable is expressed in terms of the other variable and constant.

Cognitive Apprenticeship:

Teacher will give the following situation written on a card. Students in their groups will continue to represent the situation algebraically using the given worksheet.

> Mr.Panda tells his daughter, "seven years ago, I was seven times as old as you were then. But three years from now, I shall be three times as old as you will be".
>
> **Can you say how old are they now?**

Work Sheet

Age at Present	Mr. Panda X	Daughter Y
Age Seven Years back		
Age Three Years after		
Relation of the two ages Seven years back		
Relation of the two ages Three years back		
Algebraic representation of the problem		

The Groups will make the algebraic representation of the problem as :

$$\left.\begin{array}{l} x - 7y + 42 = 0 \quad \text{.........} \; (A) \\ x - 3y - 6 = 0 \; \text{.........} \; (B) \end{array}\right\} \text{A pair of LETs}$$

How can you find out the ages from this paired LETs?

The teacher will facilitate **cognitive expansion** of the process of solving a LEO to paired LETs.

Students, you know how to solve a LEO.
But is the present situation a LEO?.
Is it possible to create a LEO from the paired LETs?
Which variable you would choose in the desired LEO? (Say, x)
Can each LET be rewritten with x separated? How?

$$\begin{array}{l} x = 7y - 42 \text{ -------- } A' \\ x = 37 + 6 \quad \text{ -------- } B' \end{array}$$

Are the Equations A' and B' are LEO?
Can you generate a LEO using A' and B'? How?
Students in their group will deliberate. In case of need the teacher will facilitate the group deliberations by reminding that the proposed LEO will have one variable. What is that – y?

Students are expected to explore at least the following two ways of generating a LEO from:-

(1) Combining A' and B' $\qquad 7y - 42 = 3y + 6$
$□4y - 48 = 0$

(2) Substituting the values of x (obtained from one LET) in the other LET.
Substituting the values of x [obtained from LET (A)] in the LET (B).

$$\begin{array}{l} 77 - 42 - 3y - 6 = 0 \\ □4y - 48 = 0 \end{array}$$

The Teacher will ask each group to state what way they could generate the LEO.
Does the obtained LEO vary with the method of obtaining it?
What would you conclude?
The teacher may emphasize that you get the same LEO using either of the method – combination or substitution.

Which method of reaching at LEO appeals to you? Why?

Students will justify their stance.

Students now you have a LEO in y generated from the algebraic representation of the situation. Can it be solved for y?

What is the present age of the daughter?

How can you find the value of x, the present age of Mr. Panda? Students in their groups will deliberate; because of inertia of thinking process students would show the tendency of repeating steps similar to A^{I} and B^{I}. That is separate y from (A) and (B) and then creating a LEO in 'x'.

However the teacher may provide assistance by way of raising a query –

Can the LETs (A) and (B) of any use to compute value of x?

Both ways of thinking need to be highlighted as alternative perspectives the same task.

Collaboration:

Students in their groups will discuss and summarize the process in which they could solve the paired LETs that is,

$$x - 7y + 42 = 0 \quad \text{........ (A)}$$
$$x - 37 - 6 = 0 \quad \text{........ (B)}$$

Each group will come up with a list of sequentially ordered steps they went through while solving the said paired LETs.

Multiple Interpretations:

Each group will present their list of steps followed for solving the paired LETs and pointing out their departures from the group (s) presented before hand.

Multiple Manifestations:

Students you all have established a procedure to solve a pair of linear equations with two variables (paired (LETs). Apply your procedure to solve this problem.

Group-1

$x + y = 14$

$x - y = 4$

Group-2

$s - t = 3$

$\frac{s}{3} + \frac{t}{2} = 6$

Group-3

$\frac{3x}{2} - \frac{5y}{3} = -2$

$\frac{x}{3} + \frac{y}{2} = \frac{13}{16}$

Group-4

$\square 2x + \square 3y = 0$

$\square 3x - \square 8y = 0$

Group-5

$3x - y = 3$

$4x - 3y = 9$

Groups after solving will exchange the work sheets for sharing.

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- www.elcues.com/help/classx/xM3/-39k
- www.indiastudychannel.com/attachment/resources/1549-23121-Mathematics%20set%2011.doc-
- www.astro.temple.edu/~dhilloo/coourse/GENED/section6-1-HILL.ppt.
- www.lesssonplanet.com/search?

THE 5 E' S CONSTRUCTIVIST MODEL IN TEACHING MATHEMATICS

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Research Scholar
RIE,NCERT, Bhubaneswar

Introduction

Knowledge is not attained but constructed (von Glasser feid, 1989). This statement comes from a new challenge to the concept of traditional knowledge. Modern teaching concepts hold the view that it is learner centred learner driven. education has been under going a slow evolution from teacher centred education to learner centered education and now it is towards learning centered education and this demands changes in traditional method of teaching and learning which is based on objectives views of knowledge, objectivism based on the assumption that knowledge is objective, universal and complete and it can be imparted by those who have it to those who don't have it.

Constructivism on the other hand based on the assumption that knowledge is subjective, contextual and inherently partial. The basic idea about constructivism is that learner must construct knowledge; the teacher can not supply it. In other wards this theory holds the views that learning is an active process in which learners construct new ideas or concepts based upon their current and prior experiences.

Constructivist views in learning

Constructivism is associated with cognitive psychology. Constructivist learning is knowledge construction based on the assumption that learners actively create and restructure knowledge in highly individual emphasizes the importance of knowledge, beliefs and skills how an individual brings to the experience of learning. It recognizes the construction of new understanding as a combination of prior learning, new information and readiness to learn.

Fosnot (1996) defines constructivism with reference to four principles:

- Learning is an important way; depends on what we already know.
- New ideas occur as we adapt and change our old ideas.
- Learning involves inventing ideas rather mechanically accumulating facts;
- Meaningful learning occurs through rethinking old ideas and coming to new conclusion about new ideas which conflict with our old ideas.

Constructivist learning model

The latest definition of leaning is construction of knowledge. John Dewey advocated constructivism as the development of a reflective individual, with attributes of open- mindedness, wholeheartedness and responsibility. He argued for learning by doing. Piaget asserts that learning occurs by an active construction of meaning, rather than passive recipience. Learners make sense of new information by associating it with the previous knowledge that is by attempting to assimilate it into our existing knowledge. Bruner laid emphasis on discovery learning and Vygotsky on the social and cultural perspectives of learning. These thinkers laid emphasis on learner centered education and learning environments support multiple perspectives or inter relations of reality, knowledge construction ,context rich, experience based activities.

I. Kolb's (1984) Experimental Model

The model of Experimental learning takes the form of circle and suggests that for deep learning to occur a series of activities needs to be set in place. This model has four stages

Concrete experience

Active experimentation

Reflective observation

Abstract conceptualization

This model emphasizes the importance of reflection of the process of learning: it sees reflection as the basis of learning. The activity or concrete experience is of little use by itself.

II. Lawson (1989) Three phases learning cycle model

This model consists of three phases: exploration, term introduction and application. It was modified by Glasson (1993), which gives more attention to social constructivist insights into the importance of language in framing conceptions, and the consequent need for clarification and negotiations.

This model gives emphasis on class discussion and the generation of shared meaning. While some of the language focuses on individual conceptions and understandings, the process is fundamentally social and cultural.

III. Driver (1989)

(a) Orientation

(b) Elicitation of ideas

(c) Restructuring of ideas

1. Clarification and exchange
2. Exposure to conflict situations
3. Construction of new ideas
4. Evaluation

(d) Application of ideas

(e) Review change in ideas

(f) Comparison with previous ideas and going back to step (b) if needed.

IV. Generative Learning Model

- **Preliminary phase**

Teacher needs to understand the scientist's view, the children's view and his /her view.

- **Focus phase**

Opportunity for pupils to explore the context of the concepts, preferably with in a real everyday situation. Learners to engage clarification of own views.

- **Challenge phase**

Learner debates the pros and cons of their current views with each other and the teacher introduces the scientific view (where necessary).

- **Application phase**

Opportunity for application of new ideas across a range of contexts.

V Interpretation construction (ICON) design model

- **Observation:** Students make observation of authentic artifacts anchored in authentic situations
- **Contextualization:** Students access background and contextual materials of various sorts to aid interpretation and argumentation.
- **Cognitive apprenticeship:** students serve as apprentices to teachers to master observation, interpretation and contextualization.
- **Collaboration:** Learners form groups to work on the task while the teacher suggests or guide them as they proceed.
- **Interpretation construction:** Students construct interpretation of observations and construct arguments of the validity of their interpretations.
- **Multiple interpretation:** Students gain cognitive flexibility by being exposed to multiple interpretation.
- **Multiple manifestations:** Students gain transferability by seeing multiple manifestation of the same interpretation.

VI. Five E's Instructional Model

The Biological science curriculum study (BSCS) A team whose principal investigator is Roger Bybee had developed on instructional model for constructivism, called the "Five E's": Engage –Explore –Explain – Elaborate – Evaluate, which facilitate construction of knowledge.

Briefly, this learning approach as follows.

Engagement:

In this stage of Engagement, the students first encounter and identify the instructional task. Here they make connections between past and present learning experiences, lay the organizational ground work for the activities ahead and stimulate their involvement in the anticipation of these activities. Asking a question, defining a problem, showing a surprising event and acting out a problematic situation are all ways to engage the students and focus them on the instructional task. If we were to make an analogy to the world of marketing a product, at first we need to grab the customer's attention. We would not have their attention unless they have a need to buy the product. They may be unaware of a need, and in this case we are motivated to create a need.

Exploration:

In the Exploration stage the students have the opportunity to get directly involved with phenomena and materials. Involving themselves in these activities they develop a grounding of experiences with the phenomenon. As they work together in teams, students build a base of common experience which assists them in the process of sharing and communicating. The teacher acts as facilitator, providing materials and guiding the students focus. The student's inquiry process drives the instruction during an exploration.

Explanation:

The third stage, Explaination is the point at which the learner begins to put the abstract experience through which she/he provides motivation for sequencing events into a logical format. Communication occurs between peers, the facilitator or within the learner himself, working in a groups, learners support each others understanding as they articulated their observations, ideas questions and hypothesis. Language provides a tool of communicate levels. These levels, applied to elements of abstract exploration given the learner a means of sharing these explorations. Common language enhances the sharing and communication between facilitator can determine levels of understanding and possible misconceptions. Created works such as writing, drawing, video or tape recording the communications that provide recorded evidence of the learners development, progress and growth.

Elaboration:

In the stage four, the students expand and apply on the concepts they have learned, make connections to other related concepts, and apply their understanding to real world around them. For example, while exploring light phenomena, learner constructs an understanding of their path light travel through space. Examine a tempest, she may notice that the shadow of the post changes. Its location as the day grows later. This observation can lead to further shadows changing location and the changes in direction of the light source of sun application to real world events, such as where to plant flowers, so that they receive sunlight most of the day, or how to prop up a beach umbrella and shadow form the sun, are both extensions and applications of the concepts that light travels in a straight path. These connections often lead to further inquiry and new understandings.

Evaluation:

Evaluate, the fifth 'E' is an on-going diagnostic process that allows the teacher to determine if the learner has attained understanding of concepts and knowledge. Evaluation and assessment can occur at all points along the continuum of the instructional process. Displays of attainment and progress enhance understanding for all parts involved in the educational process, and can become jumping off points of further enrichment of the student's education. This evidence of learning serves to guide the teacher in further lesson planning and may signal the need for modification and change of direction. For example, if a teacher perceives clear evidence of misconceptions, then he/she can revisit the concept to enhance clear understanding. If the students show profound interest in a brunching direction of inquiry, the teacher can consider refocusing the investigation to take advantage of the high level of interest.

Reference

Fosnot, C.T. (1996). *Constructivism : Theory, Perspective, and Practice*, Teachers College Press, New York.

EXAMPLAR IN MATHEMATICS

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Grade : IX

Text Book: Mathematics Text Book (NCERT)

Subject : Mathematics

Topic : Numbers on the Number line

Duration : One hour

Learning Objectives

(A) process-based:

i. Originality
ii. Reflective thinking
iii. Flexibility /multiple interpretation
iv. Concept construction
v. Creativity
vi. Respect for evidence
vii. Curiosity
viii. Co-operation
ix. Intellectual honesty
x. The ability to form hypothesis

(B) content-based:

i. Students will be able to differentiate rational and irrational number.
ii. Students will be able to locate irrational numbers on number line.
iii. Students will be able constructing numbers of square root with in a single figure.
iv. Students will be able to simplify any expression and locate on number line.

Known concepts

- Rational numbers, natural numbers, integers, whole numbers.
- Pythagoras theorem.
- Concept of number line

Engagement phase:

To actively engage the learners in the classroom, the teacher begins the class by using the guided imaginary strategies. In these strategies, the teacher structures the following no of tasks.

Task-1

Teacher will ask all the students to write any numbers on their note sheet and classify it under natural no., integer and rational numbers and find relationship among them.

Task-2

Teacher will assign certain number to students, represent to it on number line like

-5.2.5, 45÷10

Task-3

Teacher will ask the students to find the numerical value of 22/7, 1/3, v2, v3 and represents v2, v3, v5 on number line

Task-4

Teacher now proceeding critically and ask the learners to locate following no. on number line like

2+v3, 5-v2, 5+v5, 5-v5, 1/2+v3,

Task-5

Teacher now ask the learners to construct on their paper sheet where the no's like v2, v3, v4, v5, v6,v7v8, v9to be included.

Exploration phase:

Step-1

At this point the teacher describes the process of experimental demonstration. So that the student knows exactly what action will be performed? The teacher then shares the objectives of the lesson; that the students will need to be able to describe and locate any number on number line.

Step-II

The teacher then break the students up into groups to predict the students breakup into groups the tasks/worksheet are handed out. The first risk for the students is to elect group recorder and group presenter. The recorder writes the groups conclusions and the presenter presents it to rest of the class.

Step-III

Each group is asked to make a prediction about what will happen when the demonstration /activity is performed. After about three of four minutes, each group is asked to share their inferences among themselves and their inferences written by the teacher on the black board.

Explanation phase:

The teacher has to outlines students misconceptions and cognitive conflict about representations of irrational numbers on number line based on the conclusion of each group. The amount of discussion is dependent on the accuracy of the responses, the prior understanding of students and the amount of time remaining.

Here students will get more conflict situation to locate v5 on number line.

Different situations may be come to findv5

Like

(i) (v3)+(v2)

=v3+2=v5

(ii) (v2) +(v1)

=v4+1

=v5

(iii) (v2)-(v3)

=v3-3

=v5

Teacher role is to accept all the answer of each group and trying to eradicate their misconceptions from their own realization and also encourage for further thinking.

Elaboration phase

In this stage, the students expands on the concepts what they have learned and make connections to other related concepts and how apply their understanding top the world around them. In such topic teacher can ask; construct a rectangle on graph paper whose area v10 cm2.

Make a cube whose volume is 5v5 cm3.

Evaluation phase

Evaluation, the fifth 'E' is an ongoing diagnostic process that allows the teacher to determine whether the learner has attained understanding of concepts and knowledge. Assessment can occur at all points along the continuum of the instructional process .Some of the tools that assist in this diagnostic process are: rubrics (quantified and prioritized out come expectations), teacher observation structured by checklists, students interviews,.portfolio designed with specific purposes.

In this topic teacher can ask following questions at end of learning process in order to know in depth pictures of students learning.

1. Classify which one irrational number:

v23, 0.3796, v400, 7.478478, 1.101001000100001,

2. Find three irrational numbers between

4/7 and 9/11

3. Locate 1/5+v3 on number line

4. Construct a square on graph paper whose area is 6

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- www.en.wikipedia.org/wiki/number_line-22k-
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- www.allacademic.com/meta/p24561-index.html-36k-
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EXEMPLAR IN SCIENCE

Prof. J.K. Mohapatra
Former Head and Dean,
DESM, RIE, NCERT, Bhubaneswar

Grade/Class : IX
Text Book : Science Text Book (NCERT)
Subject : Science
Topic : Motion
Concepts : "Rest and Motion"
Duration : One and half hour

Learning Objectives :

Process-based :

Students are helped to develop:

i. Originality
ii. Open-mindedness
iii. Reflective thinking
iv. Flexibility/multiple interpretation
v. Concept construction
vi. Creativity
vii. Respect for evidence
viii. Curiosity
ix. Co-operation
x. Intellectual honesty
xi. The ability to form hypothesis

Content-based:

Students will be guided to

i. Test and refine their own concepts about the concepts, 'Rest' and 'Motion',
ii. Correlate their reconstructed concepts with various life-centered situation, events, instances,

iii. Consider and internalize the importance of these concepts in areas other than Kinematics of physics

The teacher may create the learning situation by asking the students-

REST

Learning Situation:

The teacher may create the learning situation by asking the students –Named some bodies at rest,

Students are seen (research findings) to name only those bodies which are present in their immediate surrounding like, chair, table, duster, blackboard etc.

[*Note: These replies are not alternative conceptions, but are manifestations of 'Conceptual Situatedness' in their minds, i.e. students have the habit of picking up examples from their immediate vicinity.*]

To remove this 'situatedness' and infuse 'flexibility' in their thought process ICT can be profitable used.

Observation:

While confirming that their answers are correct the teacher may show video clippings/diagrams of

- A mountain
- Their school building
- Big trees in a park/farm/forest
- The village pond
- The road in front of the school

And ask-

"Are these bodies at rest"?

Possibly there will be three groups of answers.

Group-1: Students will strongly respond that all the above bodies are rest.

Group-2: This group will respond that all the above bodies except the trees are at rest, because they have seen that when there is a wind, leaves and branches of the trees shake and move.

Group- 3: This group will respond that all the above bodies except the pond are at rest, because they have seen that when there is wind or if one throws a stone into the pond, waves are created in the water of the pond.

Contextualization:

The class can now be divided into three groups along the above lines and a discussion amongst them may be initiated to arrive at a single conclusion. Teacher may channelize the discussion when arguments, advanced by any group, are out of context.

Teacher may help the student to arrive at the conclusions that.

(a) When there is a wind the leaves and branches of a tree do move but the tree as whole does not move from it place (so the trees are at rest and)

(b) When there is a wind or a stone is thrown into the pond, waves, of course, are created on the water surface, but the pond as a whole does not move from its place (so the pond is at rest).

Through this step students will also learn how open-mindedness leads to acceptable and correct understanding which is essential for organizing the experiential world.

Thus now is the time to lead them to a higher level of reflective thinking.

Cognitive Apprenticeship:

Teacher may ask some leading question.

Q.1: Are you now sure that the above five objects, the video clippings of which you have seen, are at rest?

The students will of course answer in the affirmative. The teacher may then ask,

Q.2: Are you sure? (Students will reply 'YES')

Now state- "So we agree that the 5 bodies are at rest. That is a gentleman's agreement between you & me. Do not go back on your words at a later stage".

This statement will have a dramatic effect on the students, will arouse their curiosity and get them focused in the teaching-learning activity.

Now teacher may show them,

- A working model of the solar system, available in Science Kit box, or
- A simulated video-film of the solar –system, or
- A chart of the solar-system.

Then ask-

"In the solar-system does the earth move round the sun?"

Obviously the unanimous answer from the students will be "Yes".

The teacher may ask, "Are you sure?" so as to dramatize the proceedings.

Some students may laugh on hearing such a redundant question. In any case all will reply, "Yes Sir, we are sure".

Now the teacher may make a statement. "Since the earth is moving constantly, the mountain, the school building, the trees, the pond and the road must also be moving continuously with the earth. Is it not?"

Because of "Inertia of thought" many students will say "Yes, Sir" But others will immediately comprehend the problem.

The teacher may dramatically say, "But a little earlier all of us had a gentlemanly agreement that these bodies are at **REST**".

On hearing this silence will descend on the entire class. The students will be immersed in a state of **'Cognitive Conflict'**. They will ask themselves- what is correct? Are the said bodies at rest or are they moving?

Teacher must realize that generating **'Cognitive Conflict'** is one of the most powerful tools for cognitive negotiation.

Collaboration (Group work):

The class may be divided into two groups. Group-I: Those who opine that the above objects are at **REST**. Group-II: Those who opine that the above objects are **MOVING.** The groups may be allowed to crystallize their thoughts in 5 minutes and then the leader of each group may present his/her arguments in support of the conclusion of the respective group.

Interpretation construction:

Teacher may now again follow the method of cognitive Negotiation and ask the following questions.

Q.1. Those who are of the opinion that these bodies are at the rest, where are they, as observers, located?

Q.2. Those who are of the opinion that these bodies are moving because the earth is moving, where are they, as observers, located?

Q.3. (This question is a corollary to Q.2.) Standing on the earth can you know through meaningful discussion the teacher may help the students to arrive at the the following questions.

Q.1. Those who are of the opinion that these bodies are at rest, where are they, as observers, located?

Conclusions

i. The person (say Mary) who opines that the mountains etc. are at REST is a person who is positioned on the earth.

ii. A person positioned on the earth will not be able to know that the earth is moving. (Teacher many mention in passing that through the use of refined experiment, like the oscillations of the Focult's pendulum, a person positioned on the earth can know that the earth is moving.)

iii. Only by going into outer space in a space shuttle a person (Say Mary) can observe that the earth is moving and so the mountains etc. are moving.

iv. In (a) and (c) the observer is the same person Mary. But in (a) she is positioned on the earth's surface and in (c) she is positioned in the outer space. So though in both the cases the person is the same, Mary, but as observers she is different.

v. Thus the state of **REST** of a body is a conclusion for a specific set of observers. Change the observer and the state of **REST** of the body will change.

vi. There is nothing called as the state of **ABSOLUTE REST** of a body.

MOTION

Before the discussion of **MOTION** teacher should ascertain student's concept about **MOTION**. Because like having a concept that **'REST'** is **'ABSOLUTE'**, students do have a concept that **'MOTION'** of a body is **'ABSOLUTE'**

Learning situation

Teacher may ask-

"Name some bodies in motion".

Students are seen (researching findings) to name only those moving bodies which are present in their immediate experience, like, car, cycle, train etc.

This is again a manifestation of 'Conceptual Situated ness. To remove this 'situated ness' and infuse 'Flexibility' in their thought process ICT can be meaningfully used.

Observation:

While confirming that their answers are correct the teacher may show video films (not clippings) or diagrams or pictures of the following.

- Water rushing out from a dam, the sluice gates of which have been opened.
- Launching of a satellite.
- A butterfly flying in a garden.
- Clouds floating in the sky
- Planets moving round the sun.

On asking-"Whether the above bodies are in motion"? All the students will uniformly reply that the bodies are in motion.

It may be noted that this observation extends their sphere of conceptualization from objects in their immediate surrounding to a much larger domain. This in fact is a manifestation of Vygostky's 'Zone of Proximal Development'.

Contextualization:

Now the teacher may show the students a CD film where a car is moving on the road or a train is moving in a natural back drop. The teacher may then make a statement-

"At some time or other each of you must have traveled in car, or in a bus, or, in a train"

The students will nod their heads or say 'YES' in affirmation.

The teacher will again show them the CD film depicting a train moving some where and using the technique of 'Thought Experiment' ask-

"Assume that you are sitting inside this moving train. Then as you look out through the open window, then for you, do the trees appear to move or actually move?"

All the students will definitely and spontaneously reply- "The trees appear to move,"

Cognitive Apprenticeship

Now teacher may ask-

Q.1. Are you sure that the motion of the trees is an appearance?

The students will of course answer in the affirmative.

Then ask-

Q.2. Are you sure? (Students will answer 'YES'.)

Now state-"So you agree that the motion of the trees is in an appearance. This is a gentleman's agreement between you & me. Do not go back on your words at a later stage".

This statement will have a dramatic effect on the students, will arouse their curiosity and get them focused in the teaching- learning activity.

The strong unanimous reply by the students that the "motion of the trees is an appearance"

- Indicates the 'Conceptual Situatedness' by the students in a new sense. The students have been clearly told that they are sitting inside the moving train, yet at the mental level they are still on the ground with the fixed conception that the trees are always at rest.
- It creates a situation where teacher can be one party and the students, combinedly can be the other party. Thus the teacher ceases to be the 'Director' & becomes an equal 'Actor' in the teaching-learning process. Such a transformation of the teacher's role is an important characteristic of constructivism.

- This also opens up a possibility where the students can argue with the teacher on the academic front and ask questions. This transformation of the role of the students is a positive step to teach them to "learn how to learn," and open up.
- This step will also teach the students the importance of experiments to arrive at dependable conclusions and expose them to the processes of science.

The teacher may make a statement:

"All of you say that sitting in the train when you look outside you see that the trees are moving and that the motion of the trees is an appearance. I do not agree with you. I am of the opinion that sitting in the moving train, for you; the motion of the trees is a reality. So let us proceed scientifically and examine who is correct, I or all of you"

"Do you agree with me"?

The reply obviously will be "Yes, Sir"

The teacher may ask "Suppose you are standing at the gate and you observe that a car is moving on the road. How do you know that the car is moving"?

Several answers may come.

- Sir, we see that the car is moving.
- Sir, if we measure the distance of the car from us, we will observe that the distance of the car from us is increasing with time etc.

Teacher may ask- "If we take the photograph of the car in a movie camera or video camera what will we observe?"

The teacher may even show them the video film of a moving car and ask- "By looking at the film how do you know that the car is moving?" and guide them to the conclusion that in the film, from frame to frame the position of the car is changing.

Now the teacher may expose them to a 'Thought Experiment' It may be noted that 'Thought Experiment' is an important tool for extending the students' domain of active conceptualization.

Teacher may make the following statement-cum-question.

For a moment suppose that you are standing at the gate and a moving car has just crossed you. Further imagine that one end of a roll of twine is tied to the bonnet of the car and the full roll is in your hand. Now if the car is moving and you look at the roll in your hand, what will you observe?

The students will definitely answer- "We will see that the roll of twine will open out."

The teacher may ask-"Do you have any doubt?"

The students will answer- "No, Sir."

The teacher will say- "We have reported 4 independent experiments. (a) Your seeing that the car is moving, (b) the distance of the car from you increasing with time, (c) In the movie film position of the car changing from frame to frame and (d) The roll of twine opening out. All lead to the same conclusion-i.e. the car is moving. So that the car is moving is a reality for you.

This is what Galileo had told-.."if more than one independent experiments give you the same conclusion, then that conclusion is a reality for you".

The teacher will say-"Now for moments imagine that you are sitting in the train, the roll of twine is in your hand and one end of the twine is tied to a tree. Now if you will look at the roll of twine in your hand what will you observe?"

The students will definitely say," We will see that the roll of twine will open out".

The teacher will ask, "So what will you conclude?"

It will be observed that there will be two types of responses. Some (few) will say, "The tree is moving." Others will say, "Sir, really the tree is at rest. The roll in opening out because the train is moving."

Collaboration (Group Work):

The class may be divided into two groups. Group-I: Those who opine that the tree is moving, through the use of logical analogy. Group-II: Those who opine that the motion of the tree is apparent, through the use of conceptual situated ness.

The groups may be allowed to crystallize their thoughts in 5 minutes and then the leader of each group may present his/her arguments in support of the conclusion of the respective group.

Interpretation construction:

Teacher may now again follow the method of Cognitive Negotiation and lead the students to conclude

(a) For a person sitting in the moving train, the motion of the trees is a reality.

(b) For a person on the ground the trees are at rest.

(c) The state of **MOTION** of a body is a conclusion for a specific set of observers. Change the observer and the sate of **MOTION** of the body will change.

(d) There is nothing called as the state of **ABSOLUTE MOTION** of body.

Multiple Interpretation/Multiple Manifestations:

Teacher may now divide the class into 4 groups and ask each group to seek viable answers to the following questions.

Q.1. From your experiences name 2 bodies which are at rest with respect to you but are in motion with respect to some other observer. State the position of the other observer.

Q.2. From your experiences name 2 bodies which are in motion with respect to you but are at rest with respect to some other observer. State the position of the other observer.

Let the groups present their answers, discuss the correctness of them. This will help them to clarify multiple interpretations and multiple manifestations of the concepts **'REST'** and **'MOTION'**

Exercises:

1. If you are in a bus, for you, your co-passenger is at rest or is he/she in motion?
2. You are sitting in the class-room and when you look out side you saw that a car is passing by your school. For the driver of the car are you at rest or in motion?
3. How can you make the mountain move with respect to you?
4. How can a moving train be at rest with respect to you?
5. If you make a space travel, land on the moon and then look at the earth what will you observe, the moon revolving round the earth of the earth revolving round the moon?
6. Two trains are moving with the same speed, in the same direction, on two parallel railway lines. You are sitting in the last bogie of one of the trains. Is a passenger sitting in the first bogie of the other train at rest or moving with respect to you?
7. You are biking a cycle. Your friend Ramu crosses you from the opposite direction by biking another cycle. Then
   (a) You are at rest with respect to what/whom?

(b) Ramu is a rest with respect to what/whom?

8. You are sitting in a moving train. A list of objects are given below .Then with resects to you if the object is in motion put M against it and if the object is at rest at R against it.

i. The door of the engine
ii. Wheels of your boggie
iii. The cigarette puffs coming out from the lisp of your co-passenger
iv. The ward basis of the toilet of your boggie
v. The driver of your train
vi. The hawker who crosses you
vii. The centre of the wheels of your boggie
viii. The fly flying in your boggie
ix. Your copassenger who is going to the toilet
x. Your copassenger who is standing at the door of your boggie
xi. The mountain which you see through the window
xii. The signal pasts of the station

- www.wikipeddia.org/wiki/Motion-p(physics)-69-k-
- www.en.wikipedia.org/wiki/motion-19k-
- www.hyperphysics.phy-astr.gsu.edu/Hbase/mot.html-22k-
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- www.sprott.physics.wise.edu/dembook/CHAPTER1HTM-70K-

EXEMPLAR IN SCIENCE

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Class : IX
Textbook : Textbook for Class IX, NCERT, February 2006
Subject : Science
Topic : Gravitation (Chapter 10)
Duration : One period

Teaching learning point:

The textual material on gravitation comprises a number of teaching learning points. As an example, we shall develop a constructivist teaching learning scheme on 'Analysis of motion under gravity'. This is based on simple activities which can help the learners review their own ideas about gravitation and learn more about it. The basic purpose of this exercise is to enable the students establish that it is gravity which governs the motion of a body thrown upwards as well as that of a body falling down freely. We shall adopt a simple-to-complex approach here.

Learning objectives

Content based:

When implemented by the teacher the scheme will enable the learner to-

i. Revisit concepts like velocity, acceleration and force studied in the previous chapters and apply them to real life situations.
ii. Describe the upward and downward motions of a body under gravity in terms of velocity, acceleration and force.
iii. Draw suitable diagrams showing the paths of the body and indicate on them the directions of velocity, acceleration and force at different points.
iv. Explain the variation of velocity along the path of the body.

v. Compare the motion of a body thrown vertically up and that of a body thrown at an angle.

vi. Reason that the motion of the body under consideration is because of gravitational force of the earth and that the force is attractive in nature.

vii. Give and explain other examples of free fall.

Process based:

The scheme will enable the learners to:

i. Think logically and predict events.
ii. Present and analyze thought experiments.
iii. Discover their alternative conceptions in the domain of gravitation.
iv. Think reflectively about own perceptions.
v. Construct concepts related to gravitation.
vi. Discuss and debate multiple interpretations of an event.
vii. Cooperate with the teacher and peers to arrive at conclusions.
viii. Show respect for evidence when it is opposed to expectation.
ix. Sustain curiosity and wonder about the working of nature.
x. Relate textbook knowledge to everyday world.

Learning situations

Situation 1: a freely falling body:

The teacher will show a piece of chalk or a small rubber or plastic ball to the class and name it as 'a body'. He will hold the body at some height and ask the students to predict how the ball would move if he simply drops it. ***(Logical thinking and prediction).*** The most likely answer from the students will be similar to "The body will fall down vertically." ***(Hypothesization).*** If any unusual response comes from anyone the teacher will invite him/her to drop the ball and observe. ***(Cognitive conflict).*** The teacher will ask the students to observe what the teacher is going to do. ***(Observation).*** He will then drop the body with zero velocity from a height, preferably in front of the blackboard. He will trace the path of the falling body on the board, which will look similar to that in Fig. 1. The activities of the teacher and pupils may be captured on a digital camera and then displayed for further observation and discussion. ***(ICT support).***

The teacher will indicate in the diagram two points, P and Q. He will put arrow mark the two possible directions as 'up' and 'down', and ask the students to answer the following.

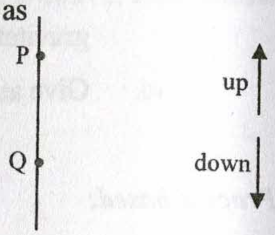

Fig. 1

Questions:

(1) What is the direction of velocity of the body at P?
(2) What is the direction of velocity of the body at Q?
(3) Is the body accelerating?
(4) If so, what is the direction of acceleration?
(5) Is there force acting on the body?
(6) If so, what is the direction of the force?

Possible answers to Questions (1), (2), (4) and (6) are from up/down, and those to Questions (3) and (5) are from yes/no. The teacher will note the answers in terms of the number of response of each category ***(Multiple interpretations)*** and help them arrive at the right conclusions which will be stated by the students. The summary of the findings will be: When a body is falling freely, its velocity increases downwards, it experiences acceleration downwards and hence a force in the downward direction. The teacher will ask the students to give other examples of a freely falling body, like falling of a fruit when it is detached from the mother tree, falling rain drop, etc. The students will realize that in each of these cases the body falls freely toward the earth. They will discuss among themselves and the teacher ***(Collaboration)*** and come to the conclusion that the earth is exerting an attractive force on each of the freely falling bodies and the force is called gravity or the gravitational pull of the earth.

Situation 2: that which goes up comes down

The teacher will take the same body and ask the students to predict what would happen when the body is thrown up. Response will be sought from all the students. ***(Hypothesization)***. The teacher may specially focus on relatively weak students and encourage them to come out with predictions. Usual answer expected is something like, "The body will go up and then come down." The teacher will note unusual answers, if any, the purpose being to unearth students' alternative conceptions. Then the teacher will throw up the body at a small angle to the vertical, preferably in front of the blackboard and ask the students to observe the motion carefully. ***(Observation)***. If needed, the action will be repeated by the teacher. Some students may be invited to do the same and see. The teacher will now go back to the student(s) who predicted differently and see that the evidence is accepted by them. ***(Cognitive conflict)***. The activities of the teacher and pupils may be captured on a digital camera and then displayed for further observation and discussion. Suitable activity-based or animated materials may be downloaded from the internet and used for further illustration. Small projects may be assigned to the students to be worked out in groups ***(ICT support)***.

The teacher will draw on the board a diagram, roughly representing the motion of the body (See Fig. 2) and ask the students what they think about The diagram and if they would like to draw it Differently and why. ***(Multiple representation)***. The teacher will identify the points A, B, C, D and E on the path of the body.

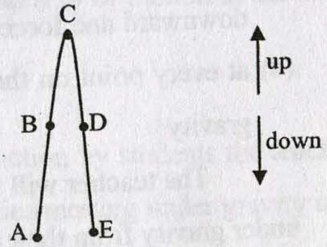

Fig. 2

The teacher will divide the students into a number of groups as per convenience and assign each group the task of finding, with the help of their knowledge from Situation 1,

(1) The direction of velocity at these points,

(2) The directions of acceleration and force during the upward motion of the body, and

(3) The directions of acceleration and force during the downward motion of the body.

The assignments will be carried out in about 15 minutes through group discussion and sharing of ideas. ***(Collaboration)***. In the process students may air their alternative perceptions ***(Multiple interpretations)*** and settle some of them through mutual discussions. The teacher will move around and see that group members are participating in the work. In case students face problems at any step the teacher will provide necessary guidance so that they can do further work on their own ***(Cognitive apprenticeship)***. A popular alternative conception of the learners is to associate motion with force, which might result in the thinking that during upward motion of the body the force acts upwards and during downward motion of the body the force acts downwards. The teacher may be able to discover this in course of interaction.

Each group will then present their findings with reasons and link them with the conclusions of Situation 1. The teacher will help them in arriving at the following conclusions ***(Interpretation construction)***

(1) the body constitutes an example of a freely falling body

(2) during upward motion of the body, velocity is upward, acceleration is downward and force is downward

(3) during downward motion of the body, velocity is downward, acceleration is downward and force is downward

(4) at every point on the path the body is attracted towards the earth by the force of gravity

The teacher will then ask the students to give other examples of bodies falling under gravity from their experience ***(Multiple manifestations)***. The teacher may point out that when somebody slips or misses his step he falls under the action of gravity and therefore we all should be careful about gravity and its effects in everyday life.

An additional exercise

Though both the above situations describe bodies in free fall under the action of gravity, there is a significant difference between them. In Situation 2 an upward force is applied to the body by the thrower's hand just before it is thrown up because of which the body, which is at rest in the thrower's hand, picks up the initial velocity that lifts up the body against gravity. On the other hand, there is no such force acting on the body that is simply dropped from a height in Situation 1 and therefore the body has zero initial velocity. The students need to realize the same. The teacher should ask them questions on these matters to find out to what extent they understand and can explain what is happening. They should be able to say what provides the initial velocity to the body in the second case. They should also reason that the force provided by the thrower's hand is a *push*, an example of 'contact force' and, that this force ceases to act on the body as soon as the body leaves the hand. This realization is particularly important since it is a popular notion (alternative conception) with many that "the force given to the body by pushing it up continues to be present throughout the motion of the body and it is this force that carries the body up against gravity". A cognitive conflict may be arranged by the teacher for the benefit of the learners in the following manner. The teacher points out that the force provided by the hand is a contact force and cannot exist when contact between the hand and the body is lost, i.e. when the body leaves the hand. The students ought to realize that the contact force is responsible for giving the body the initial velocity only and it is the force of gravitation that affects the motion of the body once it is out of hand. We expect that the students will like the exercise and the associated mental activities that will help them review and reconstruct their ideas about the why and how of motion of the body in such a situation.

ICT support

To provide further support to knowledge construction by students the teacher may look up websites and multimedia resources on bodies moving under gravity and show some of them in the classroom. Students may be encouraged to undertake this kind of beyond-the-textbook exploration on their own and share with the class if they come across anything interesting or entertaining on bodies moving under gravity.

Assessment

The teacher will assess each part of the activities carried out by the students. Level of knowledge construction can be tested through suitable formative and summative questions.

- www.en.wikipedia.org/wiki/Gravity-99k
- www.youtube.com

- www.cse/10.phys.utk.edu/astrIGI/lect/history/newtongraR.HTML.-14K-
- www.nasa.gov/worldbook/gravitation_worldbook.html-31k-
- www.answers.com/topic/gravitation_76k-
- www.physicxs.adelaide.edu.au/ASGRG/-10k-
- www.en.citizen.org/wiki/Gravitation-53k-
- www.tutorvista.com/content/science/science-i/gravitation/gravitationindex-php-36k-
- www.scienceclarified.com/Ga-He/Gravity-and-Gravitation.html-20k
- www.fourmilab.ch/gravitation/orbits/-23k-

EXEMPLAR IN SCIENCE

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Class : IX

Subject : Science

Topic : Matter in our Surroundings

Text Book: NCERT Science Text book.

Concept :

1. Matter is made up of very small particles.
2. Constituent particles of mater have space among them.

Duration: Two periods (80 to 90 minutes)

Learning Objectives:

Process based objective

To enable students to develop:

i. Respect for evidence,
ii. Tolerance for uncertainty,
iii. Open mindedness,
iv. Curiosity,
v. Intellectual honesty,
vi. Desire to understand,
vii. Sense of safety,
viii. Concept construction.

Content based objectives

After the transaction of the module, students will be able to observe the particulate nature of matter,

- Observe the particulate nature of matter,
- Comprehend the existence of intermolecular space.

Concept-1

"Matter is made up of very small particles."

Learning Situation

The teacher may carry out the following activity with the help of students. Each student may be given a sugar cube, (they identify that solid as sugar with sweet taste) asked to break that cube into smaller parts/grains (as small as possible) and taste one taste one such grain.

Caution: Students should be careful while tasting a substance, under examination, in the class.

Observation

The students note how a large number of small parts could be obtained out of the sugar cube. Each such grain when tasted found to be as sweet as the sugar cube.

Let the students explore and say whether these grains can be put together to get back the same sugar cube.

Projection of CHEM-STUDY film on 'Particulate nature of matter may be done to strengthen their constructs Discussion and Contextualization'

From the above observation and experience, students may infer that the sugar-cube is made up of a large number of small particles. All such particles are of sugar and hence have the characteristic sweetness of sugar.

For contextualization of this concept students may be divided into four groups. Each group will be given one specimen sample out of the lot (a piece of stone, a leaf of Tulsi, a crayon of chalk, a block of charcoal) and asked to treat the specimen in the same way as they did the sugar cube. At the end of the experimentation under the guidance of the teacher, they construct their knowledge on nature and composition of solid matter as detailed out in the text book.

The teacher may ascertain whether the learners can extend the concept to their daily-life situation (e.g. nature and composition of Besan ladu, Rasi Ladu etc.) Discussion on such examples may provide scope and supporting arguments for comprehension of the same concept.

Concept-2

Constituent particles of matter have space among them.

Learning Situation:

A glass tumbler was filled with soil to 2/3rd of its bulk; water was poured into the glass, up to the bim of the glass. Students observed and then noted what happened to water kept above the soil layer.(Disappearance of water.)

Teacher takes a glass tumbler containing about 30ml of water and a sugar-cube. He/she asks the students, "What would happen to the sugar-cube when it is put into water taken in the glass tumbler?"

Students may suggest the possible/expected changes both water and sugar cube will under go that they think appropriate. A few probable responses are enlisted below.

- The Sugar-cube sinks in water.
- The Sugar-cube floats in water.2/25/2009
- The Sugar-cube breaks into small pieces and gradually decreases size.
- The Sugar-cube disappears in water after some time.

They obviously come to a conclusion after observing the activity done by the teacher. Teacher then asks a student to draw a few drops of liquid from the bottom of the tumbler by means of a straw and taste. The same student then draws a few drops of liquid from the upper portion of the same liquid and tastes. He then expresses his experience (difference in taste) to others in the class. He may finally mix the contents of the glass tumbler with a spoon and takes out a spoon of liquid from any depth of the total volume and tastes. He again describes what he felt in regard to taste.

Observation

Students observe what happened to the sugar-cube inside water taken in the glass-tumbler during this investigation, they share their friend's experience in regard to the taste of the liquid at different stages. They may also note any change that takes place in water it self. (The colour and volume i.e. Well of water at different times during the investigation.)

Computer simulation of splitting of sugar cube into particles/molecules in water. Formation of the homogeneous mixture of sugar molecules and water molecules in the bulk of the solution.

Discussion and contextualization:

The teacher divides the class into four groups and assign out of the following questions to each group.

i. Does the water level in the glass tumbler change soon after adding the sugar-cube into water?
ii. What does happen to sugar-cube when water is stirred?
iii. Where do sugar particles disappear?
iv. Is there any change of colour/transparency of water?

Students work in their respective groups and find answer to the question assigned to them. One group presents their answers for discussion in the class when the teacher moderates the discussion and guides the students to reach at the correct/appropriate conclusions. In the same way, all groups present their work, discuss and arrive at correct answers.

Cognitive apprenticeship:

Teacher takes examples of other common solid lumps (suggested by students), guides the students to master/refine their skills of observation interpretation, contextualization, concept construction and finally confirm that all solids when split, produce a large number of small particles possessing the properties of that solid. These small particles when put together form the original solid-lump.

Collaboration:

Students may be divided into four groups. Each group may be provided with one sample (Preferably a soft solid). The groups proceed with their investigation on the basic knowledge they have constructed at earlier steps of this module. They collaborate/share their experiences/findings and carryout interpretation, contextualization and finally draw inferences.

Interpretation construction and multiple manifestations

From this investigation it can be concluded that matter is composed of a large number of small particles and there is space between these constituting particles of matter. This also supports the theory that matter is particulate in nature.

Some students may give examples of some tough solids which can not be divided into small particles easily by simple methods and may not consist of such small particles. This necessitates more discussion and experimentation.

Assessment:

- When a crystal of potassium permanganate is placed in a beaker containing water, its purple colour spreads through out water. What does this observation tell us [illegible] this?
- A swimmer is able to cut trough water in a swimming pool/pond, which property of matter does this observation show

Computer simulation of the above phenomenon may be shown. Students observe at the spreading of molecules of potassium permanganate in the intermolecular space of water molecules. They also observe the change of colour of the mixture.

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EXEMPLAR IN BIO-SCIENCE

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Grade/ class: X
Text book : Science Text Book (NCERT)
Subject : science
Topic : Heredity

In general learning involves three components: Content, Subject (pupils) and Process (modalities of instruction). The process are those techniques that help the pupils in learning to learn i.e. leads to generation and validation of science knowledge, nurtures the curiosity and creativity of the pupils, makes him or her receptive in the world of knowledge and skills. The constructivist mode of learning emphasizes child's involvement in exploratory activities to acquire basic cognitive and psychomotor skills. ICT provides this value added component through its ability to organize, display and analyze information's.

When it comes to integration of science with ICT, the role of teacher becomes significant. Teacher with dedication, proven imagination /foresight and creativity ensures that the key features of ICT.

Process –based Objectives

Students are helped to develop:

i. Originality
ii. Open mindedness
iii. Concept construction
iv. Creativity
v. Curiosity

Content based Objectives

Students will be guided to:

i. Distinguish between inherited and acquired characters.
ii. State the effects of environment on some of our traits.
iii. Consider and internalize the information of inherited traits in the field of medicine and for breeding purpose.

Teaching points:

i. Living things produce other living things like themselves.

ii. Only heredity traits are passed on to offspring's.
iii. The gene for a trait express itself over the other is called as dominant gene while the suppressed one is called as recessive trait.
iv. Some traits are hereditary and other is acquired.
v. Both heredity and environment are important in determining genetic trait.

Learning situation

The teachers may create the learning situation by telling the students:

On day a student went to his teacher and asked, "Yesterday I was seeing our family photograph with my parents. Both of my parents were comparing (similarities and difference) my cousins with elders of our family in photograph. So there are some scientific reasons behind the resemblance of kids with their parents".

The teacher then asked, "Some of you must have got the compliment: you are true copy of your father/mother or your eyes resemble with your father" etc. So, you must be interested to unveil this secret. Today we shall study how this occurs.

Activity

The teacher asks the students to list five characteristics each on which they resemble their parents. Then the teacher shows some video clippings of some parents and their kids and asks about the similarities and variation in them. The teacher tries to convince students that siblings resemble mostly on the following characteristics:

- Eye colour
- Face look
- Body structure

Teacher tells them that these are the characteristics which we inherit from our parents and such traits are called as inherited/transmitted characteristics.

Observation

The teacher shows video clippings/diagrams of:

- Colour of the hair
- Child who rolls his tongue
- Children having different eye colour
- Ear lobes – both free and attached
- Texture of the skin
- Colour blind child

And asks:

- Are these characters inherited?
  (Possibly all students will answer yes)

- How do you conclude that these are inheritable traits?
  (Possibly these will be two answers)

To explain this, teacher brings coins in the class and asks:

If you toss a coin once, what is the probability of getting head or tail?
If you toss two coins once, what is the probability of getting head or tail?

Again perform the same activity with 3 coins.

Here we learnt about the probability of getting one side of coin same way. The traits inherited depend upon the probability of having a combination of genes.

Common eye colour is brown and blue. Brown-eyed people are of two kinds. They may have only brown eye genes or they may have brown or blue genes in there cells. Brown eye genes are dominant while blue eye genes are recessive. Any one who has inherited any brown eye gene will have brown eye. Blue eyed people inherit only blue eye genes.

For example, your father has brown eye and has genes for only brown eye colour. Your mother is brown eyed but can contribute either brown eye gene or blue eye gene. You can't be blue eyed.

This is because your father can contribute only brown eye gene which are dominant. Even though you can by chance get blue eye gene from your mother but still you will be brown eyed.

Group-I these characters don't change with passage of time.

Group-II these character in child show resemblance with any of his family members.

Now teacher will show video clippings:

- Kid with a birth mark on his face.
- Boy with a mole on his neck.

Say that these characters show no change with passage of time. Now ask whether these are heritable characters. Possibly there will be no response from the student's side.

Now question arises as how to know which character is inheritable as both above characters are not heritable.

So, some scientist tried to explains among them most successful was a monk named Mendel who studied upon the tissue sativa plant and based on the experiment performed by him he gave some laws. These are called as laws of inheritance.

To make this concept clear teacher shows the model of DNA, explains the structure of DNA and gives a brief idea about gene. By Mendel's work it was recalled that each person has at least two genes for each trait/ character among which:

- Both may be dominant(express)
- Both may be recessive
- One dominant and one recessive

For example, for height plant T, t is 2 genes, on which
'T' stands for tallness
't' stands for short/dwarf.
And here there can be 3 combination TT, tt,& Tt . Each person gets one gene from each of his parents and the combination of both decides the characters expressed.

Observation

But if you do get blue-eye genes your children, when you have them, will have a change of getting either of R eye and it will depend upon the eye-colour gene of the other parent. And teacher provides some numerical ton students based on it. Now teacher show video clippings of:

- A woman playing piano
- A doctor doing surgery
- A blacksmith beating iron.

And ask whether these characters are inheritable or developed by the person. Possibly students will say developed.

And then teacher tells them that these are brown as inherited character. Now again teacher show video clippings of:

A plant with green leaves when kept for few days in dark changes in to yellow.

A table showing IQ level of:

- Footer child and other child living with him
- Twin reared in same environment (identical twins)
- Twins reared in different environments

The teacher asks about these characters. Possibly no response from student's side as these examples clash with wholier taught above.

Then teacher explains: This is due to the effect of immediate environment and tells that the environment also affects the character. For example, the people living in western countries have white skin even though their origin is western because of how imperatives.

So, we conclude that the characters present in us are the combined effect of genes controlling that trait and the environment.

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EXEMPLAR IN SCIENCE

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Class : IX
Subject: Science
Topic : Why do we Fall Ill
Concept: Concept of Health
Text Book: Science Text Book

Learning Objectives:

Content Based:

Students will be able to:

i. distinguish healthy state from ill-state
ii. Internalize and describe how individual's strength, feeling, thought and work performance are influenced during illness.
iii. Define health and healthy person
iv. Elaborate the concepts of physical, mental and social well being in terms of important indicators.

Process Based:

Students will be able to:

i. Think reflectively and justify why mere physical well being is not total health.
ii. Construct meanings of the term health and healthy person for themselves through negotiating their ideas with that of others.
iii. Think divergently to formulate indicator of physical, mental and social wellbeing of a person

Learning Situation:

Observation of Videos:

Students! You are going to watch a video. Please watch carefully and try to identify which persons are healthy. Pupils will be shown: video photographs of a patient, a similar person with a good physique, mad person, a sports man, a group of quarreling persons, and two Persons fighting with each other, a stressed man, a physically robust person with tear.

Students have understood health and healthy persons in their own way. Seeing these videos their understanding of health and healthy person will crystallize.

Contextualization:

After the video show, the teacher will initiate the following discussion to retrieve students' experiences when they were ill.

Q.1. How do you feel when you suffer from fever?

Q.2. Like fever can you name other illness?

Q.3. How do you feel when you are healthy?

Q.4. Whom shall you call a healthy person?

At this stage teacher explores pupils' existing ideas about healthy and ill-state of a person. Pupils are likely to focus on physical conditions disregarding the mental state, adjustment and work performance of the individual.

The responses of students will be noted down on the blackboard. This will help pupils to see how at present they conceive a healthy person.

Cognitive Apprenticeship:

Pupils will be divided into small groups of 3-4. Each group will work on the work sheet as follows:

Read Carefully:

CHIKUN a student of Class-X is five feet tall with a good physique. He takes part in many sports activities. He falls into frequent quarrels with friends. He studies well and secures good marks. Many times he remains depressed.

Now discuss among yourselves:

How do you see CHIKUN – Healthy / Sick?

Why do you think so?

The group members may converge or diverge on their views. Each group will present their views/opinions. This discussion & sharing will challenge pupil's existing conception of a healthy person (Health as good physique).

Teacher now facilitates expansion of pupils' conception and domain of thinking to mental and social dimensions of health.

Teacher: A sound body is needed for remaining healthy. Do you all agree?

Is this a sufficient condition for remaining healthy?

Can you think of situations when you did not feel well even if you didn't have physical discomforts / defect/disease?

Students will narrate different situations when they were not well even if they didn't have physical discomforts / defect. Teacher will facilitate the process such that student conclude that one may be sick even if he is free of diseases/ bodily ailments.

Collaboration:

Students form 3 groups. Each group will work on one of the following situations:

Group-1

Read the following situation:

Recall the following events:

- Parents for some reasons were very angry and scolded you heavily.
- One of your intimate friends stopped talking to you and distanced from you.

Now discuss among yourselves and prepare a Report:

- How was your feeling and thought that time?
- How was your appearance and look at that time?
- How did this influence your work performance at that time?
- Were you well/ normal that time?
- Can you think of a term that can describe you're the then condition?

Summarize your discussion & prepare a report by completing the following sentences:

1. When Parents get angry & scold we feel ______________________________
2. That time our feeling & thought ____
3. Our concentration & work performance ________________________________

4. Such conditions ______________________

Group-2

The Group Members read out and act as directed.

Think of a team of football players:

> The players are physically sound and are free from mental illness. All are intelligent too. Each player thinks that he is right but others are wrong.

1. Is this team a healthy team of players? Discuss among yourselves.
2. Do the members of your group have agreement in respect of question1?
3. Where do they agree?
4. Where do they divide?

Now discuss: Is any thing else, besides physical and mental well being players require to perform well in a match?

Pupils at this point may not go beyond their immediate thought because of their inertia of thought. In that case teacher may assist the group indicating to think of two groups of players where -. In one group players each blames each other and in the other each player manages each other's mistake.

- Which group of players is likely to perform better? Why?
- Can you think of a term to speak the way the two teams differ?

Summarize your discussion and prepare a report by completing the followings:

1. When we work in group (say playing football) each member ______________________
2. For good performance of the members of a team ______________________
3. Thought & feeling of each member ______________
8. Such qualities may be called ______________________

Group-3

Read and discuss among yourselves how the strength and work performance of a person would be affected in each of the following cases?

1. A man with a lame leg.
2. A person who can not see distinctly.
3. A man who has headache & vomiting.
4. A man who has pain on some part of body.

Are such persons healthy?

Summarize your discussion & prepare a report by completing the following lines..

1. When some part of our body is not alright.
   ____
2. Our strength ____
3. Our feeling & thought in such situations
   ____
4. Such conditions may be called
   ____

Interpretation Construction:

The 3 groups formed in Step-5 will remain intact and continue to work.

Group-1: The Group members will discuss and attempt to list some indicators/ signs/symptoms etc. to distinguish a person who is not mentally well from that who is mentally well.

Group-2: The group members will discuss and attempt to list some indicators/ signs/ symptoms / qualities etc. to distinguish a person who is socially health from one who is not.

Group-3: The group members will discuss and attempt to list some indicators / signs/symptoms / qualities etc. to distinguish a person who is physically healthy from one who is not.

Each group reads out their list for sharing. Other group members may agree/ disagree indicating their thought / view points.

Multiple Interpretations

At this stage new groups will be formed. Each group must have one/two members of the groups formed in Step-5.

Each group will discuss and write definition/ description of

(i) Who is a healthy person?
(ii) What is health?

Each group presents their definitions for sharing. Teacher will initiate discussion to find out similarity & differences in the definitions. At the end of group presentation teacher will make a power point presentation of definitions of health and healthy persons.

Health is a state of total well-being: physical, mental & social.

A healthy person is physically, mentally and socially sound and competent.

Multiple Manifestations

Students in pairs will examine the following cases to find which aspect of health is not normal in each case.

1. A mad on the road.
2. A patient in the operation table.
3. A person passing offensive comments to a woman.
4. A person who frequently discusses other's fault.
5. A man with short temper.
6. A thief
7. A cancer patient.
8. A person who sees unreal dangers.
9. A depressed adolescent

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EXEMPLER IN SCIENCE

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Class : IX
Text Book: Science Text Book (NCERT)
Subject: Science
Topic : "Why Do We Fall Ill"
Concept: Factors Affecting Health
Duration: 90 Minutes

Learning Objectives:

Content Based:

- i. **Students will identify physical, individual and community factors which influence health.**
- ii. **Students will internalize and describe how food, individual cleanliness, community practices and Environment factors influence health.**
- iii. **Students will classify different factors affecting health into suitable categories.**

Process Based:

During instruction students will engage themselves in:

- i. Interpretation & construction of information
- ii. Elaboration of ideas
- iii. Divergent thinking
- iv. Classification
- v. Situation analysis
- vi. Relating effects to their tentative causes

Observation:

The teacher will start the class by saying:

"Students, let us watch a Video on Life styles/ practices and habits of people in different habitations. Please watch it carefully."

The video comprises of sights like:

- Unhygienic physical conditions open drains, defecation on road sides, open drains out-flowing on the road, dead bodies of animals and garbage thrown around.
- Crowded streets with noisy and dusty atmosphere.
- Urban slums and city outskirts.
- Habitations near factories/industries.
- People with poor sanitary habits
- Food habits and Life styles (such as under/over eating fast food, drugs….).

Interpretation Construction:

Students in Groups of 2-3 will discuss:

Which habits / practices are harmful to health?

What kind of surrounding / habitation is not good for health? Why?

Contextualization:

The teacher will initiate and facilitate the process exploration of factors causing ill health – What makes us ill? Pupils' responses are likely to center around 'germs'. Because their present conception of factors affecting health is situated in the contexts of their experience. Teacher may note that personal experience of illness is largely saturated with germ induced illness/diseases.

What other factors besides germs may affect our health?

Ask students to deliberate in their groups and note down as many reasons as they can think of.

Children ordinarily think that good food is a need for health. Their attention may not reach improper food habits like over/under eating, fast food. The teacher is required to stimulate and explore students, thought in that respect;

Students without food can you remain healthy?

Can food be a factor for being bulky or very thin?

Can you think of other illness which may happen to us because of wrong food habit?

Cognitive Apprenticeship:

Students in groups will discuss and explore how the following factors influence health. Each group will record the summary of their discussion in the following report format.

1. Water quality in different places – Pond, open well, river / stream, bore well and PHD Supply water.
2. Air quality in crowded places – town/cities, near factories.
3. Weather conditions in different seasons.
4. Dirty and unhygienic surrounding.
5. Food habits
6. A person's thought and attitude – enviousness, rivalry, craziness for money, worry, violence, spiritually etc.
7. Natural disasters – Cyclone, Flood, Earthquake.
8. Person's awareness / Ignorance about different diseases.

REPORT FORMAT

Factor	How it may influence health	One such event/ occurrence which you have seen in your locality

Collaboration:

Pupils in their groups will continue to work. They will list different factors which are likely to affect health and will categories them under suitable headings. Each group prepares a chart to that effect.

Multiple Interpretations:

The teacher will invite views of the pupils to each list of factors after a group presents. The teacher then will make a power point presentation on condition/factors essential for health. A typical teacher presentation could be:

FACTORS WHICH MAY AFFECT HEALTH

Individual Factors	Public Factors	Natural/ Environmental factors	Psychological Factors
Nutrition, Physical labour, Exercise, Yoga, Rest/ Relaxation, Personal cleanliness, Drug avoidance, Health Awareness	Wastage / Garbage removal, drinking water supply, public habits and practices	Flood, Cyclone, Earthquake, Weather condition	Positive Attitude Low anxiety, Worry, Self contentment, Spiritually

Multiple manifestations:

Look at your village / town, the people and its surrounding.

- Can you identify the major illness of people?
- What are the reasons for that?
- Can such factors of illness be avoided?

Prepare a Report on "Health Concerns in Our Locality.

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EXEMPLAR IN POLITICAL SCIENCE

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Grade	: IX
Subject	: Social Science (Political Science)
Topic	: What is democracy? Why democracy.
Duration	: 90 minutes

Learning objectives

After the end of teaching learning process students should be able to:

i. Define democracy in their own word.
ii. Enrich their knowledge on salient features of democracy.
iii. Identify the daily life situations where the principles of democracy is followed (correlates principles of democracy to daily life situations)
iv. Describe the merits and demerits of democracy.
v. Distinguish a democratic form of government from a non-democratic government.
vi. List different forms of government.
vii. Give alternative terms of the term democracy.
viii. Show reasons for their acceptance/rejection of the principles of democracy.

Learning Situation

Situation-1

Teacher will ask the following questions to the students:

- Who is the real head of our country?

  Ans: The Prime minister.
- How is he chosen?

  Ans: Elected by the people.
- How are our leaders like MLAs, MPs chosen?

  Ans: Elected by the people.

- Who are the electors of our country?

  Ans: A citizen attaining 18 years of age.
- Name countries where rulers are elected by the people.

  Ans: United States, Pakistan
- Have you heard about the kings like Akabar, Babar, Sahajahan?

  Ans: Yes.
- How were they chosen?

  Ans: Being sons of kings.
- Were they elected by the people of the country?

  Ans: No.

Situation-2

The teacher will show/present some news paper cuttings that depict agitation of people against government; leaders in procession after being elected; and name of political parties with the number of seats won after election. The teacher asks students to narrate situation after each presentation.

Situation-3

The teacher will make a video presentation of election process and assembly/parliament session to the students followed by discussion.

Situation -4

The teacher will arrange a mock parliament/assembly in the class. The students will play the roles of speaker, prime/chief minister, leader of opposition etc. The members of house will ask questions, argue amongst themselves and pass budget etc.

Observation

Learners are expected to observe the following after situations are presented/encountered:

- The rulers of our country including the prime minister are elected by the people.
- The choice/opinion of common people is reflected in the assembly/parliament through the elected representatives.
- All people, irrespective of caste, creed and colour are equal in a democratic set up.

- In the past, rulers named 'king' were not elected by the people.
- In democracy, people agitate against the rulers openly.
- The elected representatives of our country take major policy decisions.
- Parliament is the highest policy making body of the country.
- The ballots are secret in India.

Contextualization

The students relate their observations of situations with the following aspects/contents of the text book:

- Meaning of democracy
- Common features of democratic government
- Common features of non-democratic government
- Some ideas about the democratic countries like Chile, Poland Ghana.
- Distinction between democratic and non-democratic government.
- The reason(s) behind wide acceptance of democratic form of government as against non-democratic forms.
- Various ways of defining democracy.
- Behaviour of citizens in a democratic country.

Cognitive Apprenticeship

The teacher advises the pupils to:

- Define democracy on the basis of observation made out of the situations provided- video, paper cutting, mock parliament, question answer.
- Identify the features of democracy from the contents of video on election process and proceeding of a parliament session; mock parliament; and discussion etc.
- Distinguish democratic form of government from non-democratic forms on the basis of discussions/questions-answers made under situation-I.
- Visit the websites to collect materials on democracy including different types/forms of democracy. The students may try with the key words: democracy, forms of democracy, parliamentary democracy, democratic government, to locate websites.

Collaboration

The pupils will be divided into heterogeneous groups, each consisting of 3-4 members and be assigned to prepare notes on:

- Definition of democracy
- Common features of democratic and non-democratic forms of government
- Distinction between democratic and non-democratic forms of government
- Advantages of democratic form of government over non-democratic form

One member of each group may present group opinion on these aspects. There will be question-answers, arguments, after each presentation. The members may try to establish the views of their group.

Interpretation Construction

On the basis of debates, arguments on various aspects of democracy, e.g. meaning, common features, distinction between democratic and non-democratic forms of government, advantages of democratic form of government, students may change their stand and construct opinion, which may be different from and/or broader than the previous. They tend to accept each others view on the aspects/sub-topics.

Multiple Interpretation/ Manifestations

Based on the contents of the topic; situations provided through discussion, mock parliament, video, news paper cutting; group opinions and that of other groups, the learners understand that:

- The term democracy can be defined in different ways.
- There are arrays of features applicable to democratic form of government; and still more can be explored through reflection, debate, discussion, arguments.
- The advantages and disadvantages of democracy are relative to time, interpretation quality of leadership, socio-economic and educational background of electorates etc.
- Democracy is a way of life. Democratic principles can also be applied in family, maintaining relationships with friends, leading a group

- Democracy implies freedom-freedom of speech, opinion, vote etc.

Exercises

i. List the qualities of a person to whom you would like to vote for as Member of Parliament and rank those qualities.

ii. Democratic form of government is appreciated by many. Mention the possible reasons.

iii. Justify your appreciation or rejection of democracy.

iv. Describe a situation at home, school or community where you can apply the principle(s) of democracy.

v. Define democracy in your own words.

vi. Democracy is a form of government of the people, for the people and by the people. Illustrate with examples.

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EXEMPLAR IN HISTORY

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Grade/Class: VIII
Subject- : History
Topic- : From Trade to Territory
Duration- : 90 minutes

Learning Objectives

In the process of teaching learning the students should be able to:

i. **Know that our country have variety of tribal communities.**
ii. **Group tribals on the basis of their living pattern.**
iii. **List the major activities of settled cultivators.**
iv. **Find the similarities and differences between shifting and settled cultivators.**
v. **List the living style, including food, dress, ornaments, festivals, marriage, death and birth practices etc of tribals, if any, living in their locality.**
vi. **Realize the similarities and differences in values, beliefs and practices across the tribal communities.**

Learning Situation

Situation-1

The teacher will discuss the following issues of the locality in the classroom:

- Food habits
- Dress and Ornaments
- Agricultural Practices
- Population by caste/tribe, socio-economic status
- Festivals, rituals
- Live stocks
- Forest and agricultural products

Situation-2

The teacher will make a video presentation depicting living styles of tribals- dance, music, agricultural practices, festivals, marriage practices housing pattern, food habits etc.

Situation-3

The students will be asked to list:

- Agricultural produces.
- Minor and major forest produces.
- Festivals by religion.
- Occupations by caste/tribe religion.

Situation-4

The students will make a role play of social practices, e.g. marriage, in the locality. The teachers will facilitate discussion on differences in these practices among various communities based on sex, religion, and caste/tribe.

Observation

The teacher will guide students to prepare a brief write-up about a community covering the following aspects.

- Food and drinking habits
- Agricultural practices
- Festivals
- Dance and music
- Dress and ornaments
- Marriage practices
- Child rearing practices
- Rituals pertaining to birth of a child, and death
- Habitats
- Similarities and differences across tribal communities

Contextualization

The students relate their observations of situation presented by the teacher and that in daily life with the following contents of the text book.

- Customs and rituals across the major tribal communities of our country.
- There are social and economic differences within tribes.
- Jhum or shifting cultivation practices.
- Implications of Jhum or shifting cultivation on environment.
- Life of the khonds of Orissa.
- Forest produces such as sal, Mahua, kusum and palash flowers.
- Life styles of hunters and gathers, i.e the khonds.
- Role of forest in the life of tribals, i.e. the Baigas of central India.
- Exploitation of tribals by the money lenders.
- Life styles of cattle herders, such as the Van Gujjars of Punjab, the Labadis of Andhra Pradesh, the Gaddis of Kulu (Himachal Pradesh), and the Bakarwals of Kashmir,
- Calendar and division of tasks for men and women.
- Life styles of settled cultivatiors, i.e. the Mundas of Chottanagpur, the Gonds, the Santhals.

Cognitive Apprenticeship

The teacher helps the learners to do the following:

- Explore the customs and rituals of some tribal groups on the basis of videos presentation and discussion and list them.
- Note the features of major agricultural practices. Shifting cultivation and settled cultivation.
- List the advantages and disadvantages of shifting cultivation.
- List the advantages and disadvantages of settled cultivation
- Compare the advantages/disadvantages of shifting cultivation
- Find out the contribution of forest resources on the life of tribals

- Visit the websites to know more about the life of tribals.

Collaboration

The pupil will be divided into heterogeneous groups, each consisting of 3-4 member and be assigned to prepare write up on the life of tribals covering the following aspects:

- Ways of life of major tribes.
- Agricultural practices of tribals-shifting and settled cultivation.
- Life of hunterers and gatherers.
- Calendar and division of tasks
- Forest and tribals.
- Exploitation of tribals by the money lenders

Interpretation construction

The members each group discuss on the above aspects of the topic and construct group opinion in the process of arguments, debate, probing.

Multiple Interpretations

Each group prepares a power point presentation of their work and present before the class. The similarities and differences in the group opinion are analyzed. The pupils debate, argue and question to establish their views. The teacher mediates in the discussion in a manner which helps students to accept each others view on the aspects of the topic.

Multiple manifestations

Based on the topics as discussed in the text book; situations provided by the teacher in terms video, role play and discussion, group work, and discussion; across groups, the learners understand that:

- There are similarities and differences in customs and rituals across tribes.
- Tribal economy is mostly influenced by forests.
- Shifting cultivation is detrimental to tribal life, particularly economy.
- Most of the tribals are exploited by money lenders.
- Dance, music and festivals are common to most of the tribes.

Exercises

- Describe how your life is influenced by forest.
- List the possible impacts of shifting cultivation.
- Give your suggestions how to check exploitation among tribals.
- Suggest measures for the Socio-economic development of tribals.
- Describe how lives of tribals are regulated by forest resources.
- Describe how lives of tribals are regulated by a calendar and division of tasks for men and women.

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EXEMPLAR IN GEOGRAPHY

Dr. Nityananda Pradhan
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D.A.V.College,Koraput, Odisha

Grade : IX
Subject : Social Science (Geography)
Topic : Industries
Duration: 90 minutes

Learning Objectives

In the process of teaching learning the students should be able to:

i. Name major industries in the locality, State, Country and World;
ii. Categorise industries in their locality;
iii. Propose potential industries for their locality;
iv. Identify factors responsible for the success of an industry;
v. Foresee the success or failure of an industry;
vi. Describe the system of an industry – inputs, process and outputs;
vii. Describe emergence and development of industries, particularly iron and steel industry and cotton and textile industry, in historical perspective;
viii. Link industrial development with economic development of the locality, State or Country; and
ix. State the emergence and potentials of information technology (IT) industry in India and abroad.

Learning Situation

Situation I

The teacher will divide the students into small groups. One or more group will be asked to list industries in their locality, State or Country with the following details:

Name of the Industry	Place with address	Raw materials used	Product

Another group will be asked to list industries they know on the basis of raw materials used with the following details:

Raw materials used	Name of the industry	Place with address	Product
Plants and Animal based products, e.g. leaves, wood, leather, bones			
Minerals, e.g. Alumina, iron ore			
Products from sea, e.g. fish			
Forest produce, e.g. wood, timber, roots, *Amla*			

Another group will be asked to prepare list of potential industries in their locality or any place of our country with justification as follows:

Name of the proposed Industry	Place with address	Name of product(s)	Raw materials required	Justification

One or more groups will be asked to list the merits and / or demerits (if any) of industries they know / have seen as follows:

Name of the Industry	Place with address	Demerits/ Disadvantages/ Loss

Situation – II

The teacher will present a video show on different industries of our country followed by discussion on the following points:

i. Whether the industry is small or big on the basis of approximate amount money invested, number of people engaged etc.

ii. Raw materials used

iii. Product

iv. Environmental implications

v. Gains and loss

vi. Marketing potential / export

vii. Employment potential

viii. Prospects

ix. Places where similar industries can be established with justification

Situation – III

The teacher may show some news items describing government policies on establishment of industries, gains and loss, environmental implications, people's acceptance/ rejection, management in respect of various industries.

Situation – IV

The teacher takes the students to an industry, may be cottage industry (e.g. craft), and facilitates discussion of students with the people there on the following points:

- Number of people employed
- Amount of capital invested
- Marketing of products
- Raw materials being used
- Income (loss/gains)
- Availability of raw materials

Observation

Students observe various aspects of industries, e.g. employment potentials; raw materials and technologies used; infrastructure and money invested; marketing of products as a result of field work, group discussion, presentation of video show and news clippings etc. They also observe some of these aspects in the industries- small or large scale, in their locality.

Contextualization

The students relate some of their observations on various aspects of industries made through the situations created by the teachers with the text and realise the following facts:

- Industry is an economic activity concerned with production of goods or the provision of services (e.g. tourism)
- Industries can be classified on the basis of size as small scale and large scale industries
- Industries can be classified on the basis of ownership as private sector, joint sector and cooperative sector industries.
- An industrial system consists of inputs, processes and outputs.
- Major industrial regions of the world tend to be located in the temperate areas, near sea ports and coal field.
- Major industrial regions are: Mumbai-Pune cluster, Bangalore-Tamil Nadu region, Huguli region, Ahmadabad-Baroda region, Vishakhapatnam-Guntur belt, and Gurgaon-Delhi-Meerut region.
- The world's major industries are: the iron and steel industry, the textile industry, and the IT industry.

They also relate their experiences with industries in the locality or outside. On the basis of such linkage, the students realize that:

- All industries generate employment
- The amounts of capital investment vary greatly from industry to industry.
- The technologies used in industries vary. Some industries make use of traditional manual technologies, where as others make use of modern sophisticated technologies like computer and internet etc.
- Highly qualified personnel's are not essentially required for employment in industries.
- Industries can be established in urban as well as rural areas.
- The major factors responsible for establishment of an industry are: capital, raw materials, human and infrastructural resources.
- Industrial development implies economic development of the country.

Cognitive Apprenticeship

The teacher tries to do away misconceptions, if any, among the students or refine / improve their perceptions pertaining to various aspects of industry. The following activities may be performed for the purpose:

- Ask students to deliberate on how industries will be affected if there are no rains for three consecutive years.
- Ask some students to name some industries which can be established with capital of Rs. 5,000/- to 10,000/-
- Ask students to name five industries they consider suitable for locality and give justification for each.
- Ask students to suggest three industries they consider suitable to be established in coastal areas and give justification for each.
- Government of Orissa decided to establish 20 industries for the economic development of rural poor. Suggest at least five varieties of industries and plot them in a map of Orissa.

- Advises students to visit the websites of govt. of Orissa and Govt. of India and find the major industries.

Collaboration

The students will be divided into small groups and be guided to prepare report on industries covering the following dimensions:

- The need for establishment of industry
- Industrialization and economic development of our country.
- Influence of industrializations on environment
- Potentials of industrializations in urban, rural and tribal areas.
- Employment potentials of industrializations
- Disadvantages of industrializations
- Prospects of industrializations in India

Interpretation Construction

The members of each group discuss and debate among themselves on each aspect of the report and arrive at group opinion. The members of group may vary in their opinion on a particular aspect. These variations may also find place in the report. The teacher encourages debate and varying opinions on the same issue.

Multiple Interpretations

Each group makes a power point presentation of its report before the class. The similarities and differences among the groups are discussed and analyzed. The members initially try to argue or debate to defend their group opinions on various issues but are likely to accept other's views towards the end. The teacher encourages students to keep their mind open so as to respect/accept others' views. As a result of debate or arguments, the students refine their views and/or do away some of the misconceptions. For example, they realized that:

- Only factories are not industries. The activities like preparing leaf plates or rope, running a small hotel and even agriculture for earning livelihood can be called industries.
- Industry can be established and run by a single person or group of persons.
- Industries can be established any where – towns as well as villages; by any person – rich or poor, male or female, young or old.
- The success or failure of an industry depends upon multiple factors- management, capital, availability of raw materials, government policy, and communication facilities etc. One or combinations of more factors determine the success or failure of an industry.

Multiple Manifestations

The experiences of the learner gained through the situations provided by the teacher going through the textbook, discussion / debate / argument with the peers and the teacher help them to see their environment in different perspectives: The teacher facilitates multiple manifestations. He may ask the following questions:

- Name some activities which according to you are industries but many people do not think so. You were also thinking like many people prior to going through this lesson.
- Do you consider Self Help Groups (SHGs) industries? If yes justify.

Exercises

- What would happen to your Nation, State or locality if there are zero industries? Write an essay on it.
- State the characteristics of an industrialist and non-industrialist.
- Which industries will be affected if there is inadequate rain? Give reasons.
- Which industries will be affected if there are heavy rains? Give reasons.
- If you were Chief Minister of your State, What policies would you adopt for the promotion of industries in your State?

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EXEMPLAR IN SOCIAL SCIENCE

Dr. G. C. Nanda
Head, Dept. of Education,
B.J.B.College, Bhubaneswar

Grade/Class: IX

Subject: Social Science (History)

Topic : History and Sports: The story of Cricket

Duration: 1 hour.

Learning objectives

The learning process helps the student:

i. To trace the story of cricket through a chronology of events like its origin in England, and transformation of cricket as an International sports with emergence of its various formats such as, test cricket, one day matches, and 20-20 matches.

ii. To refine his concepts about the game, its rules and regulations, equipment required and how these concepts evolved over a period of time.

iii. To compare cricket with other team games

iv. To relate the game with the nature of English society.

v. To relate his knowledge of the game with colonial history of India so as to evaluate the role of England in spreading the game.

vi. To trace the history of the game in India during pre-independence and post independence period.

vii. To evaluate the present transformation of the game from a game by gentlemen to paid professionals.

viii. To link his knowledge of the game to concepts like 'National Unity', 'fair play', 'discipline' gentlemanliness' and globalization.

Learning situation

Learners view a few video clippings from the film 'Lagan" convering the test match played by English players and Indian amateurs. Learners are asked to take note of the equipment, dress used by the two teams.

Observation

Based on observation of the video clippings students are asked to:

- Guess the period when the match was played.
- Compare the equipment used by both the team.
- Compare the dress put on by both the teams.
- Differentiate between professional and amateurs.
- Guess if the results of the game shown to them would have really happened during British Raj.
- Guess the attitude of England players towards their Indian counterpart.

Contextualization

Students are asked to recollect their knowledge of the last cricket match they have seen between India and any other country and answer to the following questions. If required, teacher may provide background information through newspaper cuttings.

Collaboration

Teacher divides the whole class into five groups and asks them to answer to the following questions:

1. Which format of cricket is better and why?
2. What is the equipment used by players now and why?
3. What are the rules of Test match cricket?
4. What are the rules of one-day cricket?
5. Why cricket is so popular now days?

Students write and discuss the answer in their respective group and present their answers to the whole class. The discussion is moderated by the teacher.

Interpretation construction

The students are asked to go through their text books and find answer to the following questions and write those in their copies. (Individual written activity)

- Why is the playing area not defined in cricket?
- How was the shape of bat changed from curved one to straight one?
- Why was the duration of the game changed from no- time- limit to fix- time- limit?
- Prove how did cricket reflect the nature of the English society?
- Why cricket is not played in countries like German and USA?
- Why cricket was allowed to religious communities during pre-independence period?
- Why 'South Africa' was boycotted by India, Pakistan and West Indies to play cricket?

Teacher supports a few students who require his help to reorganize their written answers and also engages few advanced student to help their peers in reorganizing their answers.

Multiple interpretation/Multiple Manifestation

Students are asked to work on the following questions in small groups and come up with their own interpretation to be shared with the whole class under the guided supervision of the teacher

1. Why Gandhiji was critical of cricket? Was he justified?
2. Why English rulers were not keen to promote cricket during pre-independence period?
3. To what extent the boycott of South Africa in cricket was justified?
4. Cricket should be the national game instead of Hockey. Do you subscribe to this view? Why?

5. Globalization and big money have changed cricket from a gentleman amateur sport to sports by the paid professional. Give your views.

Assessment Exercises

i. Assignment – Go through your text book and list the events relating to cricket along with dates chronologically during pre-independence and post-independence period and prepare a time line.

ii. Assignment- List the names of the country where cricket is played and find out the names of players of each country's team, collect their photographs and paste the same in your scrap book.

iii. Assignment- Collect the names of the captains of Indian Cricket team from 1932 onwards, collect their photographs and paste in your scrap book.

iv. Write an essay on how cricket is instrumental in arousing a feeling of national integration.

v. Collect news items relating to cricket across the globe and develop your portfolio

vi. Compare and contrast the three formats of cricket. Which one would you prefer and why?

vii. Considering yourself as the chairman of the selection committee of Board of Control for Cricket in India, select three separate teams for Test match, one-day match and 20-20 match. Prepare an ternary of cricket matches to be played in different venues of India with a visiting team.

viii. Select a world test team for playing cricket against India and give reasons for the selection of each player.

ix. Write an essay on how you see the future of cricket in the World as well as in India.

x. Prepare a list of questions on this lesson to conduct a quiz in your class.

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EXEMPLAR IN GEOGRAPHY

Mrs Sila Mukhaejee
Ms Minati saha
Dr. Nita Mitra
Mr Sanjib Roy

Grade /class	: IX
Subject	: Social studies
Text book	: NCERT text book
Topic	: Drainage system in India
Duration	: 90 minutes

Content Analysis

1. Concept of 'drainage' and 'drainage system'.
2. Special features of physiographic of India and the development of drainage system.
3. Location of different types of rivers and lakes on the basis of physical features.
4. Himalayan Rivers – Ganga, Indus, Brahmaputra system.
5. Peninsular River system: Armada, Tapti, Mahanadi .Godavari, Krishna and Cauvery River system.
6. Role of river lakes on the economy of the country.multi purpose River Valley Project –aims are –better irrigation, agriculture, navigation, flood control, conservation of soil, picks culture, energy production, tourism development and overall economic development.
7. River /lake pollution –causes, damages caused measures to be taken for prevention –construction of nation wide network of drainage connection.

Learning Objectives

Content Based:

After the completion of the teaching –learning process the students should be able to:

1. Reconstruct their concept of the term 'drainage system'.
2. Identify the two broad categories of drainage system existing in India in relation to the broad physical features: - Himalayan and Peninsular.

3. Identify and locate the individual 'river system' on a map of India and explain their courses.
4. Compare the different river system according to this variation of features and characteristics.
5. Describe the role of different river in the development of agriculture as the backbone of the economy of the country.
6. Explain the role of rivers in the industrial development of the country.
7. State in their own words the meaning of 'Multipurpose River Valley Project' .
8. Name the different 'Multipurpose River Valley Projects' and their utilities.
9. Show reasons behind river pollution and damages.
10. Suggest measures to be taken to prevent river pollution.

Indirect far reaching objectives:

- Enhancement of observation power
- Curiosity
- Open-mindedness
- Interact in local as well as national phenomena
- Scientific attitude of mind
- Geographical bend of mind
- Inculcation of values like sympathy, team-work, co-operation .sociability, tolerance, acceptance.

Situation-I

One group will be asked to gather information about the following details.

1.Agriculture	Name of the river from which irrigation water is available	Village/Town/Cities
a) food crops b) cash crops c) beverages d) others		
2. Industry	Name of the river from which water is supplied.	Village/Town/Cities
a) small –scale		

b) large-scale		

The third group will be asked to prepare a list of settlement which has depended on particular rivers (directly or indirectly) for their growth.

Names of settlements (Rural or Urban)	Name of the river depending on which the settlement has developed

The fourth group will be asked to make a list of rivers being polluted of the sources of pollution.

Names of River	Sources of pollution	Measures undertaken by local administrative to prevent water pollution	Further suggestion regarding prevention of water pollution

Situation-II

Through power presentation, the teacher will show a detailed drainage map of India with basin demonstration on the following points.

1. Name of the main rivers of their basin.
2. Names of the tributaries of the main rivers.
3. Identification of the relief features of the region on which the river flows.
4. Whether the rivers are perennial or non perennial, whether snow fed, rain fed or spring fed.

5. Special features produced by the rivers at different stages and at different places like rapid and waterfalls gorges ,interlocking spurs ,meanders .or bow lakes ,flood plains and levees ,deltas etc.
6. Function of the river like erosion, transportation and deposition.
7. Different types of crops produced in different river basin.
8. Types and mans of industries developed with the help of water from these rivers.
9. Multipurpose valley projects of their advantages and disadvantages.
10. Different types of pollution taking place by different means in different rivers.
11. Measures taken by different administrative bodies to prevent river pollution.

Situation –III

The teacher and the students may collect and show some news items (news paper cuttings ,selective clippings from television news telecast) describing devastating floods ,river pollution ,their effects on environment , irrigation facilities from multipurpose river valley projects enhancement in crop production (green revolution in Punjab because of Bhakra –Nangal project)etc.

Situation-IV

If possible, the teacher may take the students to a riverside or lake in the vicinity and facilities observation of the students and their interaction with local people on the following points

- Characteristics /features of the river, lake, waterfalls, rapids, meanders, river braiding of river island, flood plains, ox-bow-lakes, deltas, distributaries etc.
- Causes of river (upper, middle or lower)
- Direction of flow
- Volume of water
- Impact of river on human life occupation etc.
- Advantages and disadvantages of river impact.
- How the river water is being polluted locally.

Observation

Students observe various aspects of the drainage system of India including Himalayan river system peninsular river system, lakes in India ,the physical characteristics and features found in each river system, the influence of river on human life and occupation, multipurpose river valley projects ,their utilities and pollution found in rivers ,measures taken or to be taken to prevent pollution ,etc. as a result of presentation of vides show ,field work ,news clippings ,group discussion ,etc.They also observe some of these aspects in the rivers on their locality.

Contextualization

The students relate some of their observation on various aspects of rivers and lakes on India made through the text and realize the following facts:

1. The term 'drainage' describes the river system of our area.
2. The area drained by a single river system is called a 'drainage basin'.
3. An upland separating two drainage basins is called a water divide.
4. Indian rivers are the divided into two major groups a) Himalayan rivers and b) peninsular rivers.
5. Rivers can be perennial and imperinnial depending on the regularity of supply of water.
6. A river along with its tributaries and distributaries is called a 'river system'.
7. The three major river systems in northern India are Indus river system, Ganga river system and Brahmaputra river system (including detailed description of each).
8. The main river system of peninsular India are Narmada ,Tapti, Mahanadi, Godavari,Krishna and kaveri.
9. There are a few important lakes in India like the Dal lake of Kashmir, Nainital Lake, Chilika Lake, Pulicat Lake, Kolleru Lake, etc.
10. Rivers keep in the growth of settlement, development of agriculture, industry and as result, keep in the economy of the nation.
11. Presently Indian rivers are being extensively polluted due to various reasons.
12. Steps should be immediately taken to check river pollution.

The students also relate their known experiences about rivers of their locality with the text.

Cognitive Apprenticeship

The teacher will take an attempt to eradicate any possible misconception among the students or improve /refine their perception relating to the 'Drainage System' of India. The following activities may be performed for this purpose.

- Ask students to deliberate on how north Indian rivers differ form south Indian rivers with justification behind their statements.
- Ask some students to draw the courses of northern rivers on an outline map of India and takes their names.
- Ask another group of students to draw the courses of southern rivers on an out line map of India and label their names.
- Ask students to make a table and write the names of Indian rivers with their sources, mouths, tributaries or distributaries in the table in different column.
- Ask students to make a list of important rapids, waterfalls, gorges, River Island, deltas etc. or any other river features.
- Ask students to make a list of craps being grown with irrigation water mentioning the names of rivers or multipurpose projects from which irrigation water is supplied.
- Ask students to make a list of industries that have been benefited by rivers (with names)
- Advises students to visit websites and find information about Indian rivers multipurpose river valley projects, river pollution taking place in India, etc.

Collaboration

The students will be divided into small groups (on a heterogeneous basis) and be guided to prepare reports on the physical characteristics and economic implication of each river system in India .each group will be allotted on single river basin. The following points are to be covered by each group.

- Source and month of the main river
- Tributaries and distributaries
- Location of the river basin on a map of India
- Characteristics of the river
- Special features produced by the river in different parts of its course
- Name of multipurpose projects (if any) within the river basin and its advantages and disadvantages.
- Influences of the rivers on regional and national economy.
- Types of pollution taking place in the rivers, their causes and steps being taken.

Interpretation Construction

The members of each group discuss debate and exchange views among themselves on each aspects of the report and arrive at a group opinion .the members of groups may vary in their opinion on a particular aspect. This variation may also find place in the report. The teacher encourages debate and varying opinion on the same issue.

Multiple Interpretations

Each group makes a power point presentation of its report before the class. The similarities and difference among the groups are discussed and analyzed .the members initially try to argue or debate to defend their group opinion on various issues, but are likely to accept other's views towards the end. The teacher encourages students to keep their mind open so as to respect /accept other's views. As a result of debate or argument, the students refine their views and part with misconception if any. The teacher himself keeps his mind open to accept any new information provided by the student members. After thorough discussion the students may realize the facts that:

- All rivers are not ideal rivers showing three distinct causes:-upper, middle or lowers causes.
- Although some of them are like the Ganga.
- All rivers don't enjoy equal supply of water throughout the year; snow-fed rivers have enough supply of water all the year round while rain-fed rivers have more water during rainy season than during other seasons.

- Water falls ,rapids , gorges ,etc are features produced by rivers in their upper course while meanders ,ox-bow lakes ,etc. in the middle course and deltas ,distributaries ,flood plains and natural levees are produced in the lower course.
- Lakes may be or different origin like glacial lakes,like Dal lake or Nainital lake , coastal lakes or lagoons like Chillika lake ,Pulicut lake ,Koueru lake ,salt water lakes like Sambhar lake, lakes of tectonic origin like water lake in Jammu and Kashmir ,etc.
- The success or failure of agriculture and industry in the country depends to a large extent on river water.
- Man due to his activities is polluting river water by depositing industrial waste, heavy load of untreated urban sewage, etc.
- The rivers are gradually losing their capacity to flush out the solid waste due to decrease in volume of water because of increasing industrialization and urbanization.
- The above fact is a matter of regret concern for life in future.

Multiple Manifestations

The experiences of the learners gained through the situations provided by the teacher, going through textual matters ,discussions /debates /arguments with the peers, report preparation ,etc. help them to look at their environment in different perspectives .the teacher facilitates multiple manifestations. He may ask the following questions:

- Name some of the features produced by rivers in the Himalayan mountainous zone.
- Indicate the deltas formed by various Indian rivers in a map of India.
- Which rivers of India do you think are suitable for Multipurpose River Valley Projects and why?
- Suggest some steps that we can fallow on our own to reduce river pollution in our locality.

Exercises

1. What would happen to your locality or country if there would have been no rivers? Express your views briefly in writing.
2. State that characteristics, features of perennial and non-perennial rivers.
3. Give your views about how presence of a river influences the physical and cultural as well as economic environment of a specific locality.
4. Should all the river-basins of India be connected in a single network? Give reasons behind your opinion.
5. as a responsible citizen of India what will be your role to prevent river pollution

Reference from websites:

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Times of India, India times .com /article show /z6568035.com- -city drainage system of kolkata.

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www.avalom-download-maps.com –Relief map

www.indiastat.com/india/show.asp?sacid=145& ptid = 2& level=z_127k- agriculture : Irrigation India.

www.agriculture –industry–india.com/-Indaagro industry.

www.goldenstate images .com-pictures on water pollution.

EXEMPLAR IN ENGLISH

Dr.Sutapa Thakur
Mr.Pratap Kabiraj
Dr.Santinath Sarkar
Dr.Nabakumar Saha
Mr.Rhitabrata Chatterjee

- Class: IX
- Time : 45 minutes
- Subject : Poem
- Topic : A Slumber Did My Spirit Seal

Objectives (process based)

Reflective Thinking

- Imagination (construction of new ideas in the poem; prediction and judgment)
- Creativity
- Appreciating poetic diction
- Ability for multiple interpretation of words, phrases and ideas
- explore patterns of rhyme and its interpretation
- ability to work in teams
- ability to find out many sources of information
- ability to evaluate, summarize and interact ,the subject matter learnt from the text
- ability to use media and technology as needed

Objectives (content based)

- Specific words i.e. slumber ,seal, spirit, earthly years, motion, force, diurnal
- Theme-the physical body is dead, but the mind will remain
- Syntactic structure of the sentences and rhyming scheme
- Sentence structures used
- Construct sentences
- Express in their own words
- Grammatical terms predominant in the poem
- Evaluate and predict the feeling of the poet

Observations

Situation 1

Teacher: If someone is dead in your home, someone who is very near and dear to you, do you tend to forget about that person? Justify your comment.

Situation 2

Teacher: A video clip is shown in which a boy's mother is dead. Even after this he didn't forget her but remembered his mother. Why is this so?

Situation 3

Teacher: The poem is read, and the students are asked, whether they are able to comprehend the subject matter and rhythm of the poem, from the reading.

About the Author

- Central points of the poet's philosophy www.wordsworth.com
- Cardinal works www.sparknotes.com
- Autobiographical influence on the poem www.academia.net
- Related works www.literature-research.com
- Listen to the poem-Model reading by the teacher
- Read the poem-the students will read the poem with the help of the teacher
- Exploring the meaning of the difficult words-To facilitate students' understanding the teacher will provide with suitable options from dictionary.

Slumber

Verb (used without object) 1.to sleep, esp. lightly; Doze; drowse.**2.**to be in a state of inactivity, negligence, Quiescence or calm: ***Vesuvius is slumbering.*** –**verb (used with object) 3.**to spend or pass (time) in Slumbering (often fol. by ***away, out,*** or ***through***): ***to Slumber the afternoon away.*** **4.** To dispel or forget by slumbering (often fol. by ***away***): ***to slumber cares away.*** **–noun 5.Sometimes, *slumbers.*** Sleep, esp. light sleep.**6.**a period of sleep, esp. light sleep.**7.**a state of inactivity, quiescence, etc.

Seal-

to affix a seal to in authorization, testimony, etc.**1.**to assure, confirm, or bind with or as if with a seal: ***They sealed the bargain with a handshake.*** *2.*to impress a seal upon as evidence of legal or standard exactness, measure, quality, etc.3.to close by any form of fastening that must be broken before access can be gained.4.to fasten or close tightly by or as if by a seal: ***She was sealing envelopes. My lips are sealed.*** *5.* To decide irrevocably: ***to seal someone's fate.*** *6.*to grant under one's seal or authority, as a pardon.7.***Mormon Church.*** to make (a marriage or adoption) forever binding; solemnize.

Spirit-

1. The principle of conscious life; the vital principle in humans, animating the body or mediating between body and soul.**2.**the incorporeal part of humans: ***present in spirit though absent in body.*** **3.**the soul regarded as separating from the body at death.**4.**conscious, incorporeal being, as opposed to matter: ***the world of spirit.*** **5.**a supernatural, incorporeal being, esp. one inhabiting a place, object, etc., or having a particular character: ***evil spirits.*** **6.** A fairy, sprite, or elf.**7.**an angel or demon

Earthly –

1. Of or pertaining to the earth, esp. as opposed to heaven; worldly.**2.**possible or conceivable: ***an invention of no earthly use to anyone.***

Motion-

1. The action or process of moving or of changing place or position; movement.**2.**power of movement, as of a living body.**3.**the manner of moving the body in walking; gait.**4.**a bodily movement or change of posture; gesture.**5.**a proposal formally made to a deliberative assembly: ***to make a motion to adjourn.*** **6.** ***Law.*** an application made to a court or judge for an order, ruling, or the like.**7.**a suggestion or proposal.

Force-

1. Physical power or strength possessed by a living being: ***He used all his force in opening the window.*** **2.** Strength or power exerted upon an object; physical coercion; violence: ***to use force to open the window; to use force on a person.*** **3.** Strength; energy; power; intensity: ***a personality of great force.*** **4.** Power to influence, affect, or control; efficacious power: ***the force of circumstances; a force for law and order.*** **5. *Law.*** Unlawful violence threatened or committed against persons or property.**6.**persuasive power; power to convince: ***They felt the force of his arguments.***

Diurnal—

Adjective 1.of or pertaining to a day or each day; daily.**2.**of or belonging to the daytime **(opposed to nocturnal).3.*Botany.*** showing a periodic alteration of condition with day and night, as certain flowers that open by day and close by night.**4.**active by day, as certain birds and insects **(opposed to nocturnal).–noun 5.*Liturgy.*** a service book containing offices for the daily hours of prayer.**6.*Archaic.*** a diary.**7.*Archaic.*** a newspaper, esp. a daily one.

Teacher's Role:

Teacher acts as a facilitator, by asking meanings of these words that best suit the context of the poem explored by the students. They are also asked to justify their answers by describing authentic situation anchored in the poem.

Contextualisation

The teacher will help the student in understanding the poem by explaining the text and also the sub-text. He/She will be flexible enough to provide space to the student's interpretation too.

A slumber did my spirit seal" is one of Wordsworth's "Lucy Poems," which focus primarily on the death of a young woman named Lucy (though she remains unnamed in this poem). Many scholars and literary historians have offered theories as to who Lucy was, but her true identity remains a mystery.

The poem is comprised of only two four-line stanzas, and yet a great deal happens in this narrow space. We see the speaker's realization not only that this young woman has died, but also that bad things can happen in a beautiful world. In the first stanza the speaker is innocently unaware that age can touch the woman, but he is quickly taught a harsh lesson when she dies between stanzas one and two. The choice to hide the death between the stanzas is interesting, as it seems to imply that the speaker is unable to verbalize the pain that goes along with the sudden loss.

On the other hand, the poem may be less about the speaker's innocence than about his belief in the young woman's power. Indeed, he seems to have built her up in his mind into a goddess, untouched by age and mortality. This desire to keep her perpetually young is a testament to the speaker's feelings for the young woman.

In the second stanza Wordsworth offers an eerie description of the woman's current situation. She is blind and deaf--wholly incapable of taking in the world around her. This is a particularly painful idea in a Wordsworth poem, because he is generally so focused on experiencing the senses. The speaker also mentions that she is now without motion or force. This, of course, is true of all dead people, but by stating the obvious the speaker helps the reader to imagine the way the young woman once was: full of life and vigor.

In the last two lines the speaker describes the young woman trapped beneath the surface of the earth. In fact, she has become a part of the earth, rolling with it as it turns day to day. The very last line of the poem is especially interesting, because the speaker lists both rocks and stones, which are essentially the same. It may be that he intends to reference both gravestones and common rocks. Alternatively, the speaker may intend to emphasize the "dead" things of the earth over living things like trees (which are mentioned only once).

"A slumber did my spirit seal" is a ballad, though a very short one. The stanzas follow an abab rhyme scheme, and the first and third lines are in iambic tetrameter, while the second and forth lines are in iambic trimeter.

Cognitive Apprenticeship

- In this stage students serve as apprentices to the teacher.
- Teacher acts as a facilitator by providing activities, hints and advices. Teacher will pose problems in the form of following questions.

A slumber did my spirit seal-
I had no human fears.
She seems to the thing at could not feel
The touch of earthly years.
No motion has she now, no force-
She neither hears nor sees,
Rolledroundinearth'sdiurnalcourse
With rocks and stones and trees.

1. About whom is the poet trying to refer in the poem?
2. Why did the poet say that 'she seemed, as if she can't feel'?
3. What is the meaning and also the implication of the word 'slumber'?
4. What do you mean by' spirit'?
5. What do you understand by 'earthly years'?
6. The poet says, 'she can't see or hear'. Why is this so? Justify your point.
7. What do you understand by earth's 'diurnal course' and how is she moving with earth's motion?
8. Do you think that the poet wants to establish some relationship between the individual and that of the natural items? Justify your answer.
9. What is the central theme of the poem? Explain in your own words.
10. How can the person mentioned in the poem, 'rolled round' with earth's diurnal course?
11. Make sentences with the newly learnt words:

    slumber, seal, earthly, spirit, motion, force
12. Try to locate the difference between poetic language and that of its prosaic counterpart.

13. What the predominant sentence structures are as found in here? Try to use them on your own

Collaboration

Teacher will form groups-heterogeneous groups-consisting of 5-6 students in each group to explore answers to the questions provided earlier.

Interpretation Construction

Students discuss amongst themselves and construct interpretations observing contextual materials and background illustrations including text book and dictionary. They may write their answers and arguments in their notebooks with proper justification.

Multiple Interpretations

Teacher asks representatives of each group to present the group interpretations before other groups. Students gain cognitive flexibility by being exposed to multiple interpretations, arguments and counter arguments.

Multiple Manifestations

In this step the entities of the text (e.g., words, lines, stanza, title, etc.) can be manifested in different ways in the text. Following questions will be asked to the students for multiple manifestations.

Exercises

1. Interpret the poet's philosophy of life as reflected in the poem. Elucidate in two to three sentences.
2. Write a composition based on the following word items-nature, pleasure, peace, spirit, earthly, divine, garden, wind, Earth, green, in 50 words
3. Suppose you have seen someone die in your family or locality. What would be your reaction to the situation, and provide suitable justification for your comment?

Further Research

The students will be asked to search the web using the following 'key words'--

Wordsworth's autobiography

Wordsworth's cardinal works

Wordsworth's philosophy

Wordsworth's poetic diction

Wordsworth's related works

EXEMPLAR IN MATHEMATICS

Mr. Surapati Pramanik
Mr. Sk. Nazmul

Class : VIII
Subject : Mathematics (Geometry)
Topic : The Concept of Parallelogram
Duration: 45 Minutes

Learning Objectives:

Content based

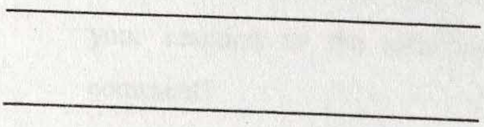
- * The students will revise the definition of parallelogram.
- * The students will understand different properties of different forms of parallelogram (parallelogram, rectangle, square, and rhombus).

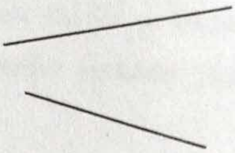
Processed based

- * The students will explore the various forms of parallelograms
- * The students will generalize the common properties among the various forms of parallelograms and the unique properties of each form

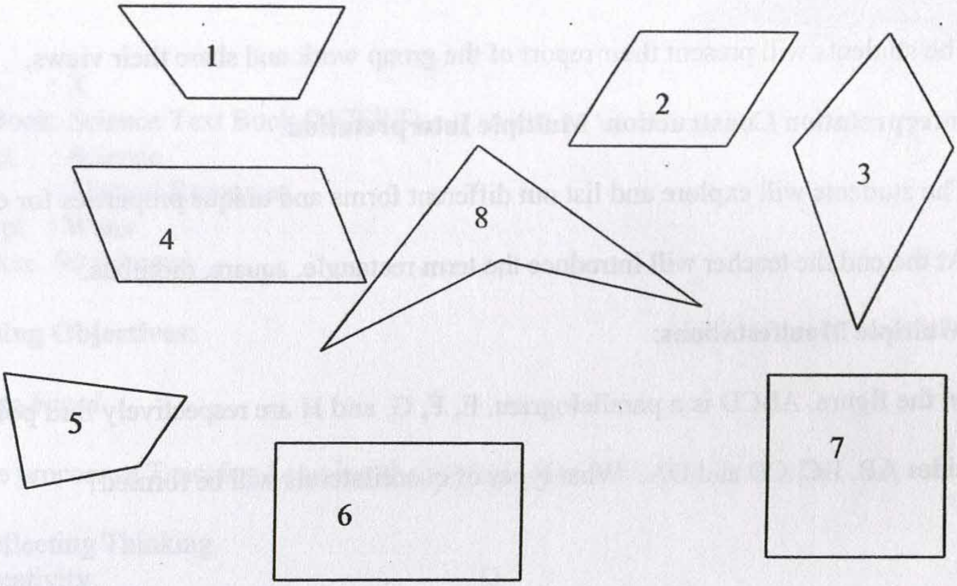
Learning Situations/ Observations:

The students observe sets of pair of straight lines and verify which is parallel or non parallel.





The teacher will show the following pictures by a power point presentation or supply the worksheets among the heterogeneous groups and to categorize the pictures according to their views based on similarities and differences and unique properties.



Contextualization

- * Based on the observations made in different situations, the students will relate the concept in different situations such as parallelogram, rectangle, square, rhombus, and quadrilaterals.
- * The students will focus on quadrilaterals where opposite sides are parallel. The students will conclude that all quadrilaterals are not parallelogram but the converse is true. The students will also explore the relationship between opposite sides, opposite angles as well as adjacent sides and adjacent angles by using protectors, scales or other geometrical instruments.

Here the teacher introduces the term parallelogram.

Cognitive Apprenticeship:

- * The students in small groups will work to explore the differences and similarities between different forms of parallelogram.
- * The students will ask the teacher for any available website where the concept of parallelogram is utilized like as www. math.yorku.ca/~whiteley.

Collaboration:

The students will present their report of the group work and share their views.

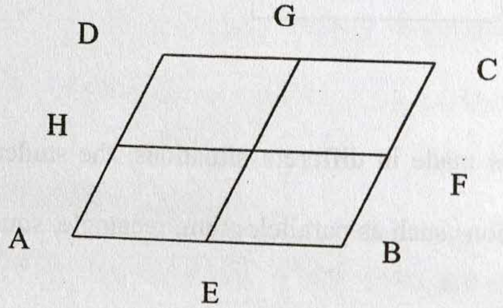
Interpretation Construction/ Multiple Interpretation:

The students will explore and list out different forms and unique properties for each form.

At the end the teacher will introduce the term rectangle, square, rhombus.

Multiple Manifestations:

In the figure, ABCD is a parallelogram. E, F, G, and H are respectively mid points of the sides AB, BC, CD and DA. What types of quadrilaterals will be formed?



Exercise:

1. On what condition a rectangle is a square?
2. On what condition a parallelogram is a rhombus?
3. From websites find some problems and solve them.

EXEMPLAR IN SCIENCE

Dr,Satyajit Kar
Dr.Sujit Pal
Dr,Nikhil KumarDutta
Dr,Nitya Gopal Mondal
Sri.Chandan Adhikary
Sri.Palash Das
Sri Kaushik Chaterjee

Grade : X
Text Book: Science Text Book (NCERT)
Subject : Science
Topic : Natural Resources
Concept : Water
Duration: 90 minutes

Learning Objectives:

Process-based

In the process of Teaching Learning the students should be able to develop:

1. Reflecting Thinking
2. Creativity
3. Reality
4. Flexibility
5. Friendly communication
6. Open –mindedness
7. Curiosity
8. Scientific Awareness
9. Peer –group Activity
10. Co-operation

Content based

At the end of this lesson, students will be able to:

1. Correlate their reconstructed concepts of proper use of water and save of water to various aspects of day to day life activities.
2. Be sensitive about environmental pollution with special reference to water pollution.
3. Realize the importance of scientific use of water and water resources.

4. Apply the conversion of quantity of water in mathematical unity (multidisciplinary approach)
5. Inculcate the value of science education.

Learning Situation:

Situation-I: "water consumption per day individual"

Teacher will distribute the survey format about, "water consumption per day per individual". The survey format will be as follows –

Name of the student:
Class
Sex:
Age:
Family Income (PM):
Residential Status (urban/rural /semi-urban):
No of family Member:

Daily Activities of water consumption	Average amount of Water consumption (BY MUG as a container)	Sources of water	Volume (in Lt.)
a) Brushing			
b) Washing of Floor			
c) Bathing			
d) Drinking			
e) Cooking			
f) Gardening			
g) Cleaning of Clothes			
h) Cleaning of Utensils			
i) Cleaning of Domestic animals			
j) Other Activities			

Situation- II

The teacher will show /present some news paper cutting /video presentation /video show /power print presentation on
1. Dirty water

2. Muddy water
3. Poisonous disease causing substance
4. Undesirable substances from water bodies

Activity centre questionnaire:

The teacher may create the learning situation by asking students:

1. What kind of water do you drink at home?
2. Where does your home drinking water come from?
3. How much water do you use at home on a day?
4. What do you mean" undesirable substances" from the water bodies.
5. Students are likely to name only those water bodies which are present in their immediate surrounding like home, school, pond, river etc.

Situation -III

The teacher will present some video clipping/diagram of:

1. Flood related water pollution
2. Domestic waste creating water pollution
3. Use of detergent /soap (optimal use)
4. Arsenic pollution and its effect
5. Water pollution caused by draining fertilizer
6. Municipal water polluted by drainage sewage
7. Surface run-off from the surrounding catchments area (especially in rainy season)
8. Marine water pollution

The teacher asks: Which of the photographs is most undesirable to us?

Possibly there will be four or five groups to answer.

Group-1: Students will strongly respond that all the above photograph are undesirable

Group-2: This group will respond in favour of arsenic pollution

Group-3: They are in favour of municipal water pollution

Group-4 Marine water pollution and chemical fertilizer causing water pollution

Group-5: Surface run-off from the surrounding catchments area

Situation -IV

Teacher will show some clippings of commercial advertisements regarding soaps and detergents in day to day life.

Then he will show 2 beakers half filled with water .He will then pour a pinch of detergent in beaker-1 and a pinch of soap in baker-2 and stir the both and allow to observe where the leather in such .

Teacher may ask the students

1. What type of powder you use in your home for washing clothing, washing utensils.
2. Which one is a bio-degradable /
3. Which creates more environmental hazards?

Contextualization

The class can now be divided into five groups along the above lines and a discussion among them may be initiated to arrive at a single conclusion .Teacher may channelise the discussion when arguments, advanced by any group are out of context. Teacher may help the students to arrive at the conclusion that –

Group: I Non-biodegradable pollutants are more hazards than biodegradable pollutants (soap, detergent experiment /municipal water polluted by draining sewage) Although detergent gives us more foam/lather and easy clean than the soap but from the ecological point of view detergent is more harmful pollutant than soap.

Group: II: How water pollution creates health hazards (flood related water pollution /arsenic pollution and its effect)?

Through these steps students will also learn how open –mindedness leads to acceptable and correct thinking under which studying is very much essential for organizing the experimental world.

Thus now is the time to lead them to higher level of reflective thinking.

Cognitive Apprenticeship

Teacher may ask some leading questions:

Q.1 When would you find the adverse effect in aquatic life and why?

Q.2 When did you observe that the marine nutrients could also be depleted from the poisonous substance (water bodies) and why?

Q.3. When did you observe the disease accusing organism like the bacteria which cause cholera and why?

Q.4.Why did you think that soil is not used for making good quality of bricks?

Q.5. In which season the water bone disease are more preventive and why?

Collaboration (Group work)

Students write and discuss the answer in their respective group and present their answer to the whole class by their group study .The discussion is moderated by the teacher. The group may be allowed to generalize their concepts about respective content /their thoughts in 5 minutes and then the leader of the each group may present their arguments ion support of their findings.

Interpretation Construction

The students are asked to go through their tboextbook, other references books and use the website and find answer to the following questions and write these in their copies (individual written activity)

1. If a glass of water is apparently looking very clear, if it is always safe for the purpose of drinking.
2. For the purpose of cleaning cloths and utensils of your household which one will you prefer from the environmental perspectives?
   a)Detergent powder
   b) Soap

Multiple Interpretations

Students are asked to work on the following questions in small group and come up with their own interpretation to be shared under the guidance of their teacher.

1. What is the main criterion for safe drinking water?

2. Mention about any low –cost indigenous process for water purification.
3. Enlist any four point resources water pollution from your immediate surroundings

Multiple Manifestations

The experiences of the learner gained through above situation provided by teacher going through the text book, discussion, video clippings, interactive multimedia with the peers and teacher follow the method of cognitive and lead the students to conclude about eco-friendly approaches towards water conservation.

Exercise

1. What would happen if there is no water body in your locality?
2. What is the major source of fresh water in the city /town/village where you live? Do you know any activity which may pollute this water sources?
3. We know that many human activities lead to increasing levels of pollution of the water bodies and soil .Do you think that isolating these activities to specific and limited areas would help in reducing pollution?
4. Write notes on how forests influence the quality of water resources and soil?

Websites

- www.data.undp.org.in/shdr/chhatishgarh/chapt-11-40-pdf.-naturalresources:waterForestandland.
- www.ignca.nic.on/cd_07006.htm-32k-traditional knowledge and management of Natural resources
- www.gwadi.org/WEES-2007.pdf-water is one of our most natural resources
- www.parisaramahiti.kar.nic.in/nr_grdwater.html-12k-
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- www.dnr.alska.gov/m/w/water/-14k-
- www.circleofBlue.org.waterResources

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NCERT

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NCERT